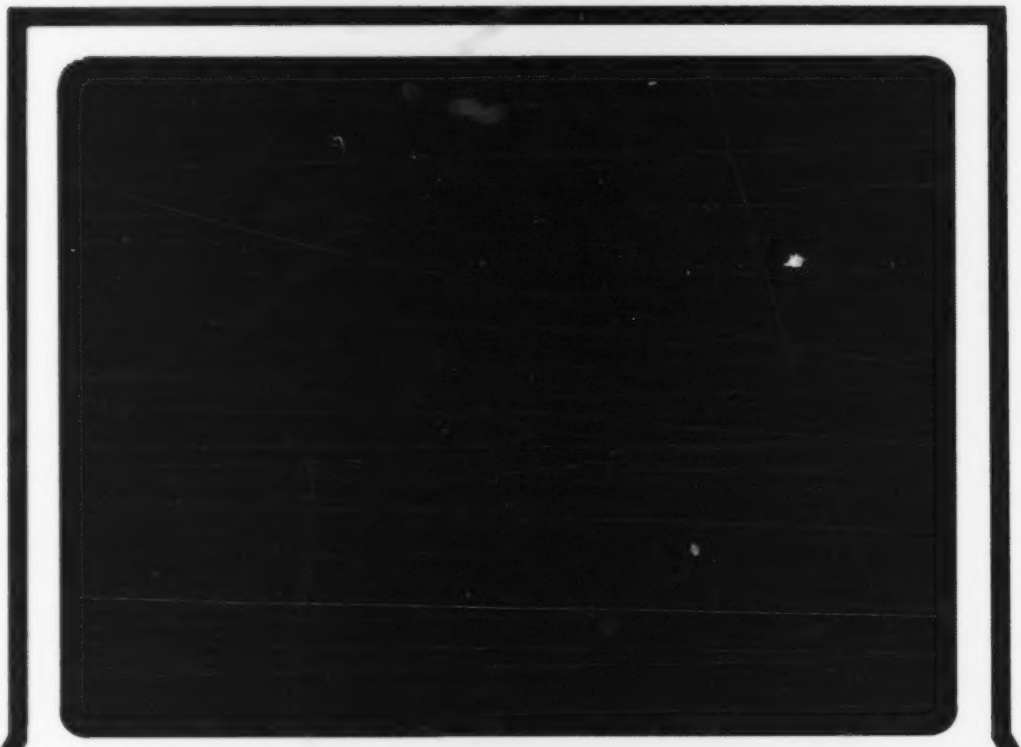
FARM

Food and Agriculture Regional Model

II DAIRY



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FOOD
FOOD AND AGRICULTURE REGIONAL MODEL
II 3 DAIRY PRODUCTS

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FOREWORD

This publication is one of a series of ten forming *Food and Agriculture Regional Model (FARM)*, which consists of the following:

Part I	*Overview*,
Part II	*Commodity Components:*
	Livestock,
	Grains and Oilseeds,
	Dairy,
	Poultry and Eggs,
	Retail Demand,
	Accounting,
Part III	*Estimation Results*,
Part IV	*Computer Software*, and
Part V	*Data Appendix*.

For an introduction to, and a general description of the model in its entirety, see Part I, *Overview*.

The results presented in this report relate to the dairy component only and treat other sectors of the model as exogenous.

The results reported are an update of the earlier version of the technical report released on a limited basis in 1980. The model is currently used on a regular basis in preparing outlook information in Agriculture Canada.

This report is preliminary and unedited and should not be quoted without the author's permission. The views in the report do not necessarily represent the views of the Government of Canada.

This report is prepared by M. Côté.

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CONTENTS

Foreword

II 3	Dairy	7
II 3.1	Introduction	7
II 3.2	Characteristics of the sector	7
II 3.2.1	Setting	7
II 3.2.1.1	Milk supply	7
II 3.2.1.2	Dairy product processing	7
II 3.2.1.3	Demand	8
II 3.2.1.4	Government	8
II 3.2.2	Scope of the dairy component	9
II 3.3	Theoretical motivation	10
II 3.3.1	Demand	10
II 3.3.2	Price determination	10
II 3.3.3	Production of milk and cream	10
II 3.3.4	Processing of milk products	10
II 3.3.5	Milk product inventories	11
II 3.3.6	Trade	11
II 3.3.7	Policy	11
II 3.4	Structure of the dairy component	11
II 3.4.1	Block structure	11
II 3.4.2	Equation specification	12
II 3.4.2.1	Milk and cream production	13
II 3.4.2.2	Milk product processing	13
II 3.4.2.3	Milk product inventories	13
II 3.4.2.4	Price linkages	14
II 3.4.2.5	Demand	14
II 3.4.2.6	Policy	14
II 3.5	Data	14
II 3.5.1	Sources	14
II 3.5.2	Data problems	14
II 3.6	Empirical results	14
II 3.6.1	Representative results	14
II 3.6.2	Interpretive results	15
II 3.7	Validation of the dairy component	16
II 3.8	Assessment	19
II 3.8.1	Application of the dairy component	19
II 3.8.2	Future work	19
II 3.9	Notes and bibliography	19
II 3.9.1	Notes	19
II 3.9.2	Bibliography	20
II 3.10	Appendix	21
II 3.10.1	Appendix A — List of variables and equations	21
II 3.10.2	Appendix B — Estimation results	28

TABLES

II 3.1	Representative specification for the dairy component	13
II 3.2	Representative empirical results for the dairy component	15
II 3.3	Intra-sample (1st q. 1970 to 4th q. 1980) and extra-sample (1st to 4th q. 1981) simulation results for the dairy component	16

FIGURES

II 3.1	The Canadian dairy industry	8
II 3.2	Target and support prices	9
II 3.3	Flowchart of the dairy component	12
II 3.4	Total milk shipments	16
II 3.5	Inventory of dairy cows	16
II 3.6	Commercial inventories of evaporated whole milk	18
II 3.7	Retail price index of butter	18
II 3.8	Gross target return for industrial milk	18
II 3.9	Support price for skim milk powder	18

II 3 DAIRY

II 3.1 Introduction

The dairy industry is an important component of the agricultural sector in Canada. Its functioning is related to those of the beef and grain components, but is, in addition, dependent upon governmental policies that seek to achieve nationally defined objectives. The primary goal of the dairy component of the Food and Agriculture Regional Model (FARM) is to provide short-term forecasts of major industry characteristics, such as milk supply and demand, in a sufficiently detailed manner to permit analysis of underlying strengths and weaknesses. An additional objective of the dairy component is to develop a tool for assessing effects of current policies and alternatives to them.

The discussion which follows describes the industry, the model, representative statistical results, and simulations for the dairy component. Mnemonic code definitions referred to in the text are found in Appendix A, with the complete listing of the equations of the component, as well estimation results are presented in Appendix B.

II 3.2 Characteristics of the sector

II 3.2.1 Setting

The size, importance, and structure of the Canadian dairy industry has been described in detail elsewhere.[1] However, as background for the present specification, it is important to review briefly the recent history and current state of the industry. Most importantly, the role of government must be described in some detail. This review therefore discusses milk supply, milk product processing, milk and milk product demand, and the nature of government influence during the period from 1965 to 1981.

II 3.2.1.1 MILK SUPPLY

In 1981, there were about 50,000 dairy producers milking about 2 million dairy cows. Total market supply amounted to approximately 73 million hectolitres of milk.[2] Since the mid-1960's, the number of dairy producers has been decreasing rapidly. Farms have, on the average, grown and become more specialized and efficient. The quality of the dairy herd has improved markedly in the past ten years; from 1971 to 1981 the average milk yield per cow increased 25 percent.[3]

An important factor influencing the supply of milk and the structure of the industry is the classification of producers as shippers of fluid milk, of industrial milk, or of industrial cream. The classification is made according to the potential end use of the milk shipped, as determined by specific quality standards. Recently, many industrial milk shippers have entered the fluid milk market through a graduated entry program. Shipments of farm-separated cream have decreased to about one quarter from the level of ten years ago. The importance of this classification is two-fold; first, prices received for the three classes of milk are different, and second, fluid milk may be used in the industrial sector, but industrial milk may not be used in the fluid sector. Farm-separated cream is used only in the production of butter.

Beef prices have influenced the milk supply during the last ten years. In the short term, beef prices have significantly affected dairy-cow slaughter, and consequently, milk supply. In the longer term, profitability in the beef industry has affected the transfer of resources from one sector to the other, as the relationship of milk supply to beef prices in the early 1970's proves.[4]

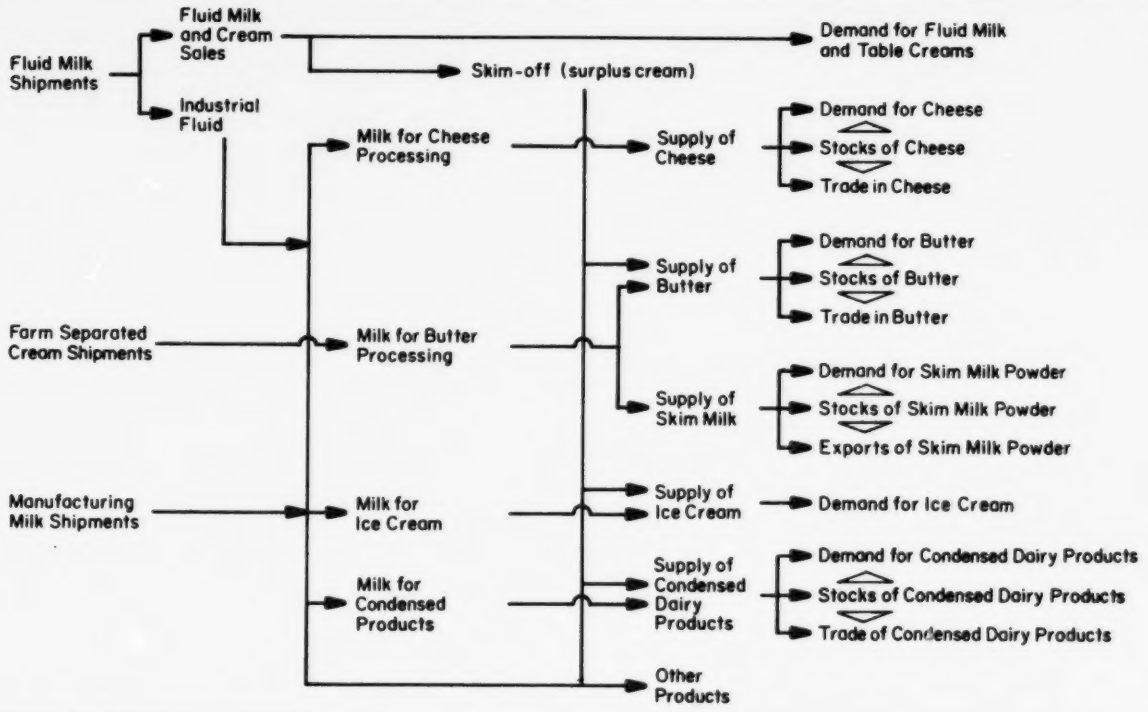
A final important feature is the seasonal nature of milk production. Historically, milk production has been highest in summer and lowest in winter. However, this has moderated over the past ten years, and currently a more uniform supply is produced each quarter.

II 3.2.1.2 DAIRY PRODUCT PROCESSING

Figure II 3.1 illustrates how milk is allocated to the production of dairy products. The flowchart emphasizes that surplus fluid milk and skim-off cream can become part of the industrial milk market, but that no manufacturing milk is used for fluid purposes. Since the federal government purchases butter and skim milk powder (offered in carlots) at the support price, excess supply of industrial milk is allocated to the production of these products.

Two important features which concern the production of skim milk powder are worth noting. First, since more milk is being shipped as whole milk rather than as farm separated cream, a greater supply of non-fat milk solids has resulted, which in turn has increased the supply of skim milk powder.

FIGURE II 3.1 THE CANADIAN DAIRY INDUSTRY



Second, with an increased demand for various types of low-fat fluid milk, the amount of skim-off fluid cream has been increasing. This cream has augmented the butterfat supplied by the industrial milk sector, lowering the requirements for industrial whole milk and the supply of non-fat solids. Despite this declining trend in industrial milk shipments, excess supplies of non-fat solids transformed to skim milk powder are a continuous problem.

II 3.2.1.3 DEMAND

During the past decade the consumption of fluid and industrial milk (in milk equivalence of products) has declined substantially in per-capita terms. Total consumption in volume terms represented about 72 million hectolitres of milk in 1981 and was approximately the same as in 1971. The 28 percent decrease in butter consumption has been chiefly responsible for this phenomenon, but the consumption of evaporated whole milk has also declined drastically by more than 50 percent. Cheese consumption, on the other hand, has grown in per-capita terms almost 60 percent in the past ten years.

The basic influences in restructuring the demand for dairy products appear to have been a renewed weight-consciousness, and particularly a concern over high cholesterol diets. These influences have shifted the demand away from butterfat and more towards non-fat milk solids. A further influence affecting demand has been the recent lower birth rate, which has resulted in smaller numbers within the highest milk and milk-product consuming segment of the population.

II 3.2.1.4 GOVERNMENT

An understanding of the Canadian dairy industry since 1965 must include a knowledge of the extent and complexity of governmental influence at the producer, processor, and consumer levels. McCormick (1972–73) and, more recently, Stonehouse (1979)[5] have thoroughly discussed the structure of governmental policy instruments. The ensuing discussion will serve to outline the important features of public intervention.

For fluid milk products, the nature of government influence is relatively straightforward. Provincial governments manage their fluid sectors by establishing quotas and prices for fluid milk. Provincial management structures vary from province to province. However, all fluid milk produced in excess of fluid quota is used in the industrial sector, and any constraints on the production of milk, in terms of over-quota penalties, are made within it. Since industrial milk products may be transported easily across provincial boundaries, the federal government, by agreement with the provinces, exercises responsibility for the national industrial milk sector.[6] The regulation of the industrial milk sector is much more complex than that of the fluid sector, and so critical to the commodity market variables of the industry that it requires further comment.

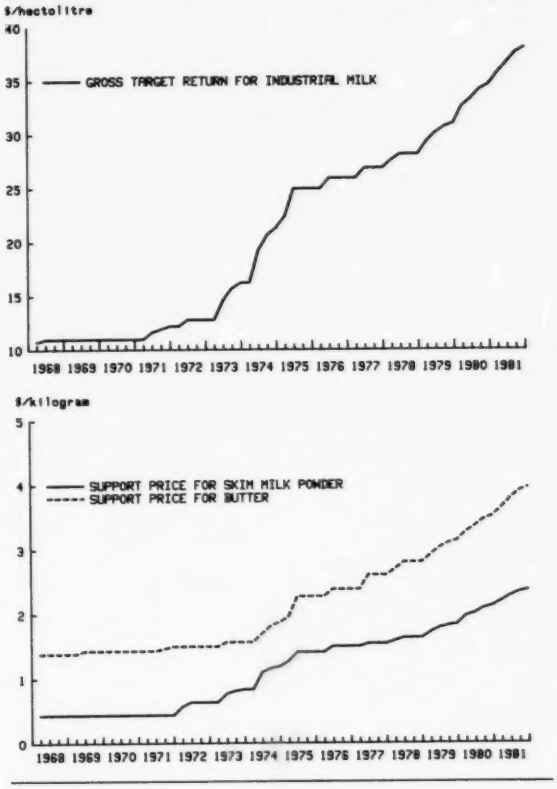
The agent for the federal government has been the Canadian Dairy Commission (CDC), which was established in 1967 to manage federal government activities in the industry.[7] Since 1967, these activities have included the management of a target returns formula, payments of direct producer subsidies on industrial milk shipments, (since 1961), the management of an offer-to-purchase plan for butter, skim milk powder, and Cheddar cheese, and the exportation and importation of dairy products. The Commission has also been involved in the establishment of consumer subsidies for skim milk powder (1973–78) and for fluid milk (1973–74).

In 1967, the CDC limited the government's subsidy program to include only milk shipped for industrial use (not on surplus fluid milk) up to a quota limit. This quota was initially established on the basis of 1966 industrial milk production. In 1970, the CDC set up a national market sharing quota (MSQ) system to manage the industrial milk supply. Full provincial participation was achieved in 1974. Through this plan, the CDC has paid a subsidy based on MSQ and has allocated MSQ to provinces. The Commission has also collected in-quota levies to finance export losses incurred in exporting excess skim milk powder and has also collected, since 1970, over-quota levies to penalize over-production.[8] It is important to note that the quota system is effected entirely through a price mechanism. Producers may produce in excess of quota, but they must pay price penalties if they do so.

A detailed assessment of CDC policies is not necessary here; it is sufficient to state that the CDC has achieved its primary goal of national self-sufficiency in butterfat at prices that ensure adequate returns to producers.

The plots of the CDC producer target price and the support prices for butter and skim milk powder (Figure II 3.2) illustrate that until 1975 these policy instruments were usually reset in the second quarter of each year. After this date, with the establishment of the target price formula, they have been reset more regularly, and in other quarters. Nevertheless, these prices typically remain constant for several months, and are then re-adjusted; their plotting lines follow a step-like pattern. These aspects of institutional behavior will have to be accounted for in modelling if the factors influencing the setting of these instruments are to be identified.

FIGURE II 3.2 TARGET AND SUPPORT PRICES



II 3.2.2 Scope of the dairy component

The dairy component comprises five blocks. These encompass milk production, processing, distribution and retailing of milk and milk products, milk and milk product demand, and a policy block designed to endogenize major policy variables. The current model consists of 60 equations, 38 of which are stochastic. The component has been designed to capture data for the period 1970 to the present, typified by extensive government influences in the industry.

On the supply side, the component solves for yield per cow, total milk shipments, farm-separated cream shipments, and the stocks of dairy cows and dairy heifers. For milk products the model solves for the production, inventories, trade, prices, and demand of creamery butter, cheese, ice cream, skim milk powder, evaporated milk, and standard and low-fat fluid milk. In the policy block, the component solves for gross and net producer returns, support prices for butter and skim milk powder, assumed processing-plant margins and average producer fluid prices.

II 3.3 Theoretical motivation

II 3.3.1 Demand

The theory underlining retail demand behavior is discussed in Section II 5.2. In brief, conventional demand theory has been used in the specification of the dairy-product demand equations. Demand for particular products is, therefore, in this context assumed to be related to income, product price, and appropriate prices of substitute and complementary products.

II 3.3.2 Price determination

Price determination in the dairy industry is largely dependent upon policy support and target prices. Determination of these prices is discussed in Section II 3.2.1.4. The theoretical arguments underlying price transmissions from the farm to the retail level are in Part I, *Overview*. Some special features of the prices mechanism should be noted. First, the farm price for industrial milk used is the net target price to producers, and is, therefore, determined within the context of policy-setting behavior. The farm price for fluid milk also a policy variable (determined provincially) is similarly included. Second, the wholesale prices of milk products, other than butter and skim milk powder (policy variables), are assumed to be functions of butter and skim milk powder support prices. This functional relationship arises from an arbitrage process in which milk for these alternative uses is bid for. (See Section II 3.3.4).

II 3.3.3 Production of milk and cream

Traditional production theory implies that equilibrium rates of production are determined by marginal cost and revenue conditions, the former being determined by input prices and opportunity costs, and the latter by the commodity price. A fully developed theory of milk production is not intended to be presented here since it can not be applied within the context of a supply management scheme. In its place we used the factors affecting the average shipment of milk per cow and the inventories of dairy cows to explain milk production.

Decisions made by producers are considered to have an impact on two variables determining the milk supply: the dairy herd size and the average shipment of milk per cow. The later reflects most of the technological progress and improvements in feeding practices. These improvements are influenced by factors such as the cost of the dairy rations, the availibility of hay and the revenue opportunity for in-quota and over-quota production. The producers also try to adjust the size of their dairy herd to fill the production quota without overproducing. This is particularly true for the quota binding period since 1976. Before that time, the profitability of the industry was the main aspect considered by dairy farmers in their decision to increase, maintain or decrease the herd size. The variations in the size of the heifer herd depend not only on a biological phenomena relating the heifer numbers to the cow numbers but also on economic factors. Depending on beef prices and expected milk prices, some heifers are sold for slaughter while the rest are kept to add to the dairy cows herd.

II 3.3.4 Processing of milk products

Section II 3.2.1.2 outlined the processing sector of the dairy industry. Figure II 3.1 (The Canadian Dairy Industry) indicated the manner in which milk is allocated to competing uses. Theoretically, milk purchased by processors may be treated as an input, whose allocation to the production of the various commodities is a function of the relative net returns from processing and selling these commodities. Thus a specific commodity's rate of production is a function of the milk-flow rate, and of the relative prices of the alternative commodities. Accordingly, the supply of milk is allocated to the competing uses. Given an allocation of milk to, say, n different commodities, only $n - 1$ decisions may be determined independently, with the nth decision determined by the supply constraint (processing-plant milk quotas, principally in Ontario, complicate this process).[9] Since government offers-to-purchase apply to butter and skim milk powder (joint products), production of these products may be considered residually. Thus the support prices act as floor prices, and the arbitrage process for raw milk determines the quantities produced of each dairy product, and the prices of the non-supported products.

II 3.3.5 Milk product inventories

The motivation underlying the milk-product inventory-holding behavior relationships in the dairy component is conventional in nature, as described in Part I, *Overview*. However, certain features should be described in detail. First, the offer-to-purchase program for butter and skim milk powder influences whether inventories are held commercially or publicly. In this program, the CDC finances major storage costs, and thereby encourages industry to speculate on changes in the respective support prices. The size of butter and skim milk inventories kept for transactions will be determined by the brokerage fee that the CDC charges and by the speed with which inventories can be transferred from public to private storage. Since within the offer-to-purchase program processors may sell butter or skim milk powder to the CDC at anytime, government inventories have been treated residually. Commercial inventories are assumed to be stochastically determined by both transactionary and speculative factors. For the commercial inventories of cheese and evaporated milk, similar relationships hold, but since the government has rarely held significant inventories of these products, the speculative element is expected to be less important than those of butter and skim milk powder. However, commercial inventories of cheese are obtained residually rather than deriving production or net trade that way.

II 3.3.6 Trade

World prices of dairy products are considerably below domestic prices. Trade in these products is highly regulated by the CDC, with import restrictions applied to every product. Besides, most of the exports of cheese are also constrained by trade agreements with the U.S.A. and the E.E.C. Consequently net trade in cheese is treated exogenously since almost completely determined by imports and exports quota restrictions. Exports of evaporated milk is also considered exogenously but for a different reason: export sales concluded by the CDC represent the majority of the volume of trade. Net trade in butter and skim milk powder is largely in the hands of the CDC, which attempts to sell its inventories at a minimum loss. Consequently, net trade in butter and skim milk is considered a function of inventory size and speculative variables. However, net trade in butter can also be treated exogenously given the small volumes it has involved in recent years.

II 3.3.7 Policy

In economic analysis, governmental regulatory instruments have traditionally been viewed as exogenous elements. Yet experience indicates that governmental decisions, made in pursuit of specific goals, arise in reaction to or anticipation of these goals not being achieved, or for both reasons. Signals from the political and economic domain and the use of basic economic analysis influence changes in the governmental policy instruments.

For the dairy component two sets of policy instruments are identified. Composing the first group are the basic instruments affecting production and market price: producer target returns, support prices and quota eligible for subsidy. The other set of instruments relates to the financing of the CDC and includes the in-quota holdback and the over-quota penalty. These are levies adjusted to ensure producers finance those operations of the CDC in which the commission acts as a clearinghouse for the excess supply of milk products. Since for the latter set, revisions are usually done once a year and they are not subject to quarterly variations, they are treated exogenously. On the other hand, the instruments of the former set are frequently changed from quarter to quarter. In consequence, they are endogenous with the exception of the quota eligible for subsidy which is set exogenously.

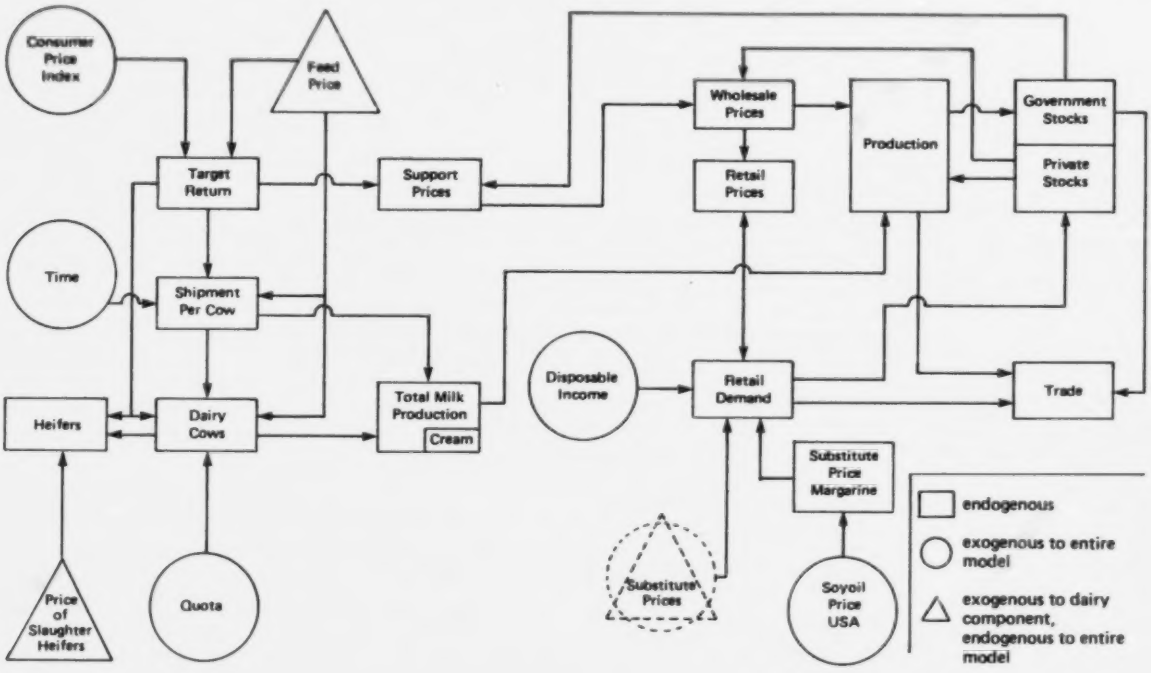
II 3.4 Structure of the dairy component

II 3.4.1 Block structure

The five basic blocks which constitute the dairy component and their general interaction are illustrated in Figure II 3.3. This flow chart does not attempt to illustrate the detailed structure of the component, but it does indicate its causal flow, and it identifies the primary influences which are exogenous both to the dairy component and to the agricultural sector model and those which are exogenous to the component but endogenous to other components. The following discussion attempts to describe in detail the interactions within the dairy component and its linkages with the rest of the agricultural sector.

The most important exogenous influences to the agricultural sector model which affect the dairy component are the Consumer Price Index (CPI), per-capita disposable income, population and some specific hypothesis about dairy policy and net trade. The price of 16 percent dairy ration, the price of slaughter heifers are exogenous to the dairy component, but endogenous to the remainder of the agricultural sector model. In this way, the dairy component is linked to the beef and grain components — the price of slaughter heifers affects the inventory of heifers while the price of feed affects target returns and short term feeding practices.

FIGURE II 3.3 FLOWCHART OF THE DAIRY COMPONENT



The main flow in the model can be traced starting in the policy block by following the effect of an increase in the CPI or the price index of the 16 percent dairy ration, which raises (depending on the quarter of the year) the target return. This adjustment generated in the policy block is then transmitted to the supply block through the new net target return. At the same time the new support prices determine the wholesale prices of other dairy products. The new milk supply and the wholesale prices determine the adjustments in the production of the specific commodities. Wholesale prices largely determine the retail prices, which in turn affect retail consumptions. Commodity production and expected wholesale prices determine commercial inventories, the size of which helps to determine wholesale prices in the following period. Trade in cheese and evaporated milk is treated exogenously because of trade restrictions and other reasons. Trade in butter and skim milk powder is related to previous period inventory levels and skim milk powder export price. Finally, skim milk powder stocks feedback to the policy block, influencing the split between the support prices.

Other exogenous influences, such as per-capita disposable income, affect the retail demand block. These influences work through the model by changing the stocks and production levels. Changes in exogenous policy variables affect milk production through the net target return, the shipment per cow or the dairy herd size.

The lags which are operational between blocks are important but difficult to identify in a summary form. More knowledge about the effective speed of adjustment to the policy decisions, as well as to the other exogenous influences, will be available only after careful scrutiny of dynamic multipliers.[10]

II 3.4.2 Equation specification

A detailed listing of the equations is in Appendix A.

The objective of this sub-section is to illustrate, with specific examples, specifications representative of those employed in modelling various types of behavior. These representative specifications are set out in Table II 3.1.

TABLE II 3.1 REPRESENTATIVE SPECIFICATIONS FOR THE DAIRY COMPONENT[ab]

Average Shipment per Cow

1. SPC3 = f(JSi, XNTM3(−1), FPDR2(−1), YHY3(−1), SPC3(−1), XPMOQ3(−1), JSi*TIME)

Inventory of Dairy Cows

2. IDC3 = f[(1 + D1976)*(XQM3/sum (I = −1 to −4: SPC3(I)), SPC3(−2), (1−D1976)* (XNTM3(−1)/FPDR2(−1))]

Shipments of Milk and Cream off Farms

3. SMKC3 = (IDC3 + IDC3(−1))/2000*SPC3

Production of Cheese

4. QFC3 = f[JSi, WPCH3, (4.32*XWPCB3 + 8.24*XWPPM3), QFC3(−1)]

Commercial Inventories of Evaporated Milk

5. CIEM3 = f[JSi, QEM3, DEM3 − sum (I = −1 to −4: DEM3(I)/4), CIEM3(−)]

Price Linkages for Cheese

6. WPCH3 = f(4.32*XWPCB3 + 8.24*XWPPM3, CIFC3(−1)/DFC3(−1), WPCH3(−1))

7. RPPC3 = f(WPCH3, WPCH3 − WPCH3(−1), ER34, RPPC3(−1))

Demand for Low Fat Milk

8. PCMS3 = f(JSi, LOG(RPFM3), LOG(RPPM3), LOG(PCDY3), LOG(TIME))

Gross Target Returns

9. XGTM3 = f(JSi, XFTM3(−2), XGTM3(−1)) before 1975 f[JS1*XFTM3(−2) + XFTM3(−2) + JS3*(0.66*XFTM3(−2) + 0.33*XFTM3(−3)) + JS4*XFTM3(−3)] after 1975

Support Price of Skim Milk Powder

10. XWPPM3 = f(XGTM3, EXPPM3, GIPM3(−1))

[a] Definitions of mnemonic codes are in Appendix A.

[b] JSi stands for quarterly seasonal dummies.

II 3.4.2.1 MILK AND CREAM PRODUCTION

The three major equations of the supply block appear in Table II 3.1. Equation 3 derives the total milk production from the average cow yield and the inventory of cows, two variables which the producer may attempt to vary in the short or long term. The specification explaining the average shipment per cow includes the net target return, the feed price, the yield of tame hay, the over-quota milk price and a time variable to account for technological progress. In the cow inventory equation, two different periods are considered: for the quota binding regime starting in 1976, the specification comprises a desired number of cows and the lagged dependent variable; and profitability ratio completes the specification for the pre-1976 period.

II 3.4.2.2 MILK PRODUCT PROCESSING

The specification for the production of cheese illustrates the modeller's intent to treat the various milk products as if they competed for a given milk supply. The weights on the butter and skim milk powder prices represent the number of kilograms of product that can be made from a hectolitre of milk.

II 3.4.2.3 MILK PRODUCT INVENTORIES

The specification for evaporated milk inventories illustrates the typical arguments used in specifying throughput and unexpected demand. It should also be noted that the butter and skim milk powder inventory equations include a speculative behavior variable which is the first difference in their own support price.

II 3.4.2.4 PRICE LINKAGES

The price linkage specifications are illustrated by equations 6 and 7. The effective support price of industrial milk, as determined by the weighted combination of the wholesale support prices, is the chief determinant of the wholesale price of cheddar cheese (used as a representative price for all cheese). The lagged ratio of end of period stocks over domestic disappearance completes the specification. The vertical wholesale-retail price transmission includes the Canada-U.S. exchange rate to account for imported cheese. However, variables reflecting price mark-up like average weekly wages and oil price were kept in specifications only when significant.

II 3.4.2.5 DEMAND

Specification 8 in Table II 3.1 typifies those employed in the dairy component. An exception is the specification of the demand for butter which is in a log form and where some coefficients are restricted in order to keep the per capita disposable income coefficient positive. A dummy variable also appears in the specification to account for the butter advertising campaign that took off in 1980.

II 3.4.2.6 POLICY

The gross target return and support price of skim milk powder specifications are also listed in Table II 3.1; other policy specifications are different from these and are in Appendix B. The specification for gross target returns uses XFTM3, a variable which calculates this price according to the target return adjustment formula. The use of a dichotomic variable permits the equation to be stochastic before the introduction of the target return adjustment formula in 1975 and to become an identity for the second part of the period. The specification takes into account the facts that the gross target return is never adjusted in the fourth quarter of the year and that the third quarter adjustment, if any, becomes effective on August 1st. The specification for the support price of skim milk powder includes besides the gross target return, variables related to the disposal of that surplus product.

II 3.5 Data

II 3.5.1 Sources

Major sources of data required for the model are the Statistics Canada's *Dairy Review* and the unpublished worksheets of the CDC. All the supply-disappearance data used and all the milk production data are from the *Dairy Review*, except for pre-1975 data on shipments of farm-separated cream. All historical values of policy variables have been taken from CDC annual reports. The unit price of skim milk powder exports has been taken from Statistics Canada's *Export by Commodities*.

II 3.5.2 Data problems

A few problems with data led to the construction or reconstruction of required series. For example, because only semi-annual data are published on the stocks of dairy cows and heifers, they are made quarterly using a linear interpolation method.

As there are no historically published data for skim-off cream, a series had to be generated, using the sales of low-fat fluid milks. This measure is a crude approximation since it does not net out the use of fluid cream as table cream. Hence, it does not agree with CDC calculations.

It should be noted that all data may not correspond with the published sources due to their conversion to metric measurements.

II 3.6 Empirical results

II 3.6.1 Representative results

The dairy component was estimated using ordinary least squares and quarterly data for the period from 1970 to 1980. In this section some representative results are tabled for illustration and comment. Estimation results for each stochastic equation of the component are listed in Appendix B. Estimated coefficients are accompanied by their standard errors in parenthesis below. Coefficients of determination, Durbin-Watson statistics and the standard error of the residuals are shown as well.

Table II 3.2 lists results that illustrate the estimated specifications of the various important influences in the dairy component. For instance, in the average yield per cow and cow inventory equations, factors like net target return, feed price, yield of tame hay, desirable herd size and profitability ratio have the intuitively correct sign and are significant at the 95 percent level of confidence.

The coefficients in the equations for evaporated milk inventories, the cheese production and wholesale price all bear the anticipated sign and are, in most cases, significantly different from zero at 95 or 90 percent level of confidence. In general, the degree of fit is acceptable but, as usual, the inventories, because of their great variability, are more difficult to capture in an equation. These equations demonstrate the close linkage between milk product production, inventories and wholesale price as these have been specified for the component. A more significant effect of the cheese stocks to demand ratio on wholesale price was, however, expected.

As for the other equation in the policy block, the results for the gross target returns equation indicate a high level of significance, and all coefficients have the expected sign.

II 3.6.2 Interpretative results

A comprehensive analysis of the estimated results to determine the responsiveness of endogenous values to important predetermined variables is facilitated with a detailed study of dynamic multipliers. Partial elasticity measures, and interpretations of distributed lags, computed equation by equation, may, in fact, not reflect the true system properties. However, in absence of multiplier analysis, a discussion of certain interpretive results may at least provide a basis for comparison, and, in addition, enable an initial assessment of how realistic the results are.

TABLE II 3.2 REPRESENTATIVE EMPIRICAL RESULTS FOR THE DAIRY COMPONENT[a]

1. SPC3 = −4.30 − 1.68*JS1 + 9.84*JS2 + 6.21*JS3 + 2.20*log(XNTM3(−1)) − 1.30*log(FPDR2(−1))
(2.42) (3.03) (2.27) (0.76) (0.55)
+ 2.16*log(YHY3) + 3.43*log(SPC3(−1)) + (0.64 + 0.46*JS1 − 1.39*JS2 − 0.85*JS3)*log(TIME)
(0.88) (1.19) (0.93) (0.54) (0.65) (0.53)
+ 0.14*log(XPMOQ3(−1))
(0.05)
R2 = 0.988 D.W. = 1.46 S.E.R. = 0.225

2. IDC3 = −141.81 + (96.41 + 91.43*D1976)*XQM3/sum (I = −1 TO −4: SPC3(I))
(59.94) (31.02)
+ 0.89*IDC3(−2) + 1401.28*(1−D1976)*XNTM3(−1)/FPDR2(−1)
(0.038) (424.88)
R2 = 0.981 D.W. = 1.18 S.E.R. = 19.85

3. QFC3 = 4.30 − 1.27*JS1 + 7.88*JS2 + 4.46*JS3 + 9.41*WPCH3 − 0.639*(4.32*XWPCB3
(1.07) (1.37) (0.91) (4.78) (0.455)
+ 8.24*XWPPM3) + 0.550*QFC3(−1)
(0.140)
R2 = 0.921 D.W. = 1.94 S.E.R. = 2.11

4. CIEM3 = −4.75 − 3.69*JS1 + 6.16*JS2 + 4.04*JS3 + 0.190*QEM3 − 0.379*(DEM3−SUM
(1.16) (1.66) (1.21) (0.062) (0.067)
(I = −4TO − 1:DEM3(I))/4) + 0.822*DEM3(−1)
(0.111)
R2 = 0.808 D.W. = 2.06 S.E.R. = 2.561

5. WPCH3 = 0.181 + 0.049*(4.32*XWPCB3 + 8.24*XWPPM3) − 0.074*CIFC3(−1)/
(0.012) (0.082)
DFC3(−1) + 0.530*WPCH3(−1)
(0.112)
R2 = 0.993 D.W. = 1.48 S.E.R. = 0.067

6. XGTM3 = (1−D1975)*(−19.90 − 0.318*JS1 + 0.700*JS2 + 0.295*JS3 + 1.54*XFTM3(−2)
(0.332) (0.362) (0.308) (0.568)
+ 0.275*XGTM3(−1)) + D1975*(JS1*XFTM3(=2) + JS2*XFTM3(−2) + JS3*(0.667*
(0.325)
XFTM3(−2) + 0.333*XFTM3(−3)) + JS4*XFTM3(−3)
R2 = 0.997 D.W. = 1.45 S.E.R. = 0.486

[a] More detailed results are presented in Appendix B, *Estimation Results*. Standard errors are in parenthesis.

Selected income and price elasticities of demand for dairy products are reported in Section II 5.5.2. In this section, such measures shall be presented for average cow yield, commodity production, wholesale and retail prices. In this way, an understanding of some of the partial effects can be conveyed.

The effect of price on milk production has been the subject of much debate. Unfortunately, the long-term effect of price on supply in the dairy component cannot be assessed without multiplier calculations. Besides, with this version of the model, effects of the net target return and the feed price are calculated relative to average shipment per cow rather than total production. The initial one-period effect of an increase in net target return in the output per cow equation is reasonable, the elasticity at the means is 0.24. The elasticity of yield with respect to feed price is $-.14$.

There are some interesting results in the milk-product processing equations. A 1 percent increase in the effective support price of industrial milk decreases cheese production 0.66 percent whereas the elasticity of production with respect to own wholesale price is 0.67. This implies that unless the elasticity of the cheese price with respect to the milk support price is almost one, an increase of the milk support price will cause a decrease in cheese production. In fact, in the wholesale cheese price equation, the estimated elasticity with respect to the milk support price is only 0.44 in the short term, and 0.93 in the longer term, indicating that the arbitrage process for milk takes some time to work itself out. The same calculations cannot be done for butter since it is the residual product in the milk allocation process, and consequently the butter production equation is an identity.

The elasticity of retail prices with respect to wholesale prices has long been a topic of interest. For fluid milk prices, the estimated elasticity with respect to the farm price is 0.28 (long-term 0.69). For the retail price of butter, the elasticity with respect to the wholesale price is 0.67 (long-term 0.86), for ice cream, 0.14 (long-term 0.78), for Cheddar cheese, 0.38 (long-term 0.95), for skim milk powder, 0.31 (long-term 0.70), and for evaporated milk, 0.44 (long-term 0.93). Compared with the ones calculated from the previous version of the dairy component, the short term elasticities appear this time higher, except in the case of butter.[11]

These results help assess the component, equation by equation, although it may be misleading since simultaneous interactions can cause sensitivity estimates to differ from those inferred by partial elasticities.

II 3.7 Validation of the dairy component

The dairy component was simulated as a separate model, distinct from the agricultural sector model. The estimation results and list of endogenous and exogenous variables are presented in the Appendix. The model was solved for the intra-sample period from the first quarter of 1970 to the fourth quarter of 1980 and for the extra-sample period from the first quarter of 1981 to the fourth quarter of 1981. The results, as summarized by the mean percentage errors and root mean square percentage errors, are presented in Table II 3.3. (Certain results are reported for the levels of the variables because of their high variability or because these variables are not strictly positive or for both reasons.) Figures II 3.4 to 3.9 further illustrate the model's tracking ability.

FIGURE II 3.4 TOTAL MILK PRODUCTION

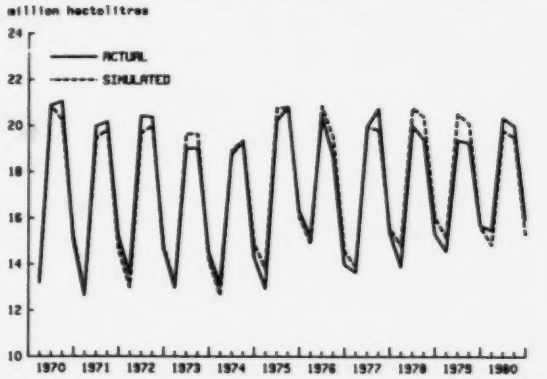


FIGURE II 3.5 INVENTORY OF DAIRY COWS

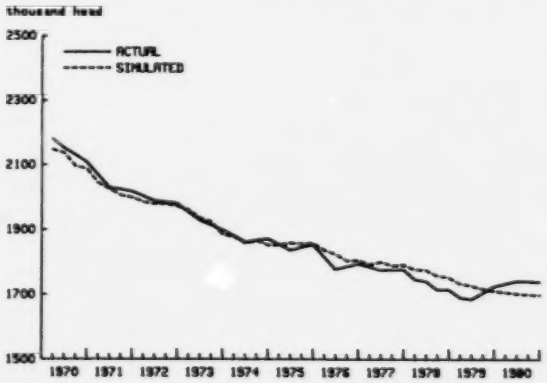


TABLE II 3.3 INTRA-SAMPLE (1ST Q. 1970 TO 4TH Q. 1980) AND EXTRA-SAMPLE (1ST TO 4TH Q. 1981) SIMULATION RESULTS FOR THE DAIRY COMPONENT

Endogenous Variable	Mean Percentage Error		Root Mean Squared Percentage Error	
	Intra-Sample	Extra-Sample	Intra-Sample	Extra-Sample
Milk Supply				
SMKC3	0.589	−1.51	3.23	2.73
SMMC3	1.16	−2.37	5.13	4.67
SFSC3	−0.114	−8.56	8.38	12.04
SMFP3	−0.343	0.183	1.29	1.23
SPC3	0.437	0.045	2.57	2.86
IDC3	0.117	−1.83	1.40	1.89
IDH3	0.791	7.00	4.21	7.83
SSOC3	−0.060	1.04	2.24	2.46
Milk Product Production				
QFC3	0.542	0.456	8.99	5.21
QIC3	0.069	−3.14	3.09	4.43
QEM3	1.52[a]	3.65[a]	6.09[a]	13.77[a]
QCB3	2.09	−5.82	10.63	9.07
QPM3	−5.57	−12.04	19.04	18.95
Milk Product Inventories				
CIFC3	5.49[a]	1.81	15.14[a]	5.75
CIEM3	1.66[a]	−0.867[a]	3.62[a]	6.64[a]
CICB3	0.057[a]	−0.787[a]	1.32[a]	1.10[a]
GICB3	0.892[a]	4.00[a]	10.58[a]	5.11[a]
CIPM3	−0.514[a]	0.980[a]	3.04[a]	2.31[a]
GIPM3	−14.19[a]	12.80[a]	48.96[a]	12.98[a]
Milk Product Trade				
EXSMP3	−2.34[a]	3.56[a]	12.52[a]	9.03[a]
NTCB3	0.241[a]	−2.64[a]	3.15[a]	2.73[a]
Milk Product Price				
WPCH3	0.627	−3.03	5.46	3.04
WPEM3	−4.06	−2.83	7.17	2.96
WPIC3	0.749	−3.40	4.65	3.80
RPFM3	0.152	0.436	3.87	1.71
RPPC3	0.534	−3.28	2.98	3.61
RPEM3	−3.43	2.16	6.74	2.23
RPIC3	0.372	10.92	2.67	11.39
RPCB3	0.237	1.30	2.84	1.40
RPPM3	1.35	5.12	5.55	5.33
RPDP3	−0.048	−0.986	3.98	1.11
Milk Product Demand				
PCMS3	−0.45	−1.37	1.10	1.81
PCLM3	−0.006	1.73	1.23	2.05
PCCB3	0.036	−0.808	6.65	3.62
PCFC3	0.137	−0.061	4.57	6.95
PCEM3	0.069[a]	0.098[a]	0.278[a]	0.697[a]
PCCRM3	0.049	2.82	3.87	3.60
DPM3	−0.172	−3.89[a]	9.18[a]	6.18[a]
Policy Variables				
XGTM3	0.621	0.111	2.35	0.184
XNTM3	0.677	0.121	2.46	0.200
XWPPM3	1.42	−0.113	4.77	0.146
XWPCB3	0.310	−0.361	3.55	0.516
XAPM3	0.954	−2.68	6.89	3.73
XFTM3	0.008	0.023	0.008	0.026
XPMOQ3	4.36	0.334	11.12	0.550
XQM3	−0.110	0.072	0.362	0.091
XPFM3	0.396	0.915	4.70	1.82
XMREQ3	0.271	−0.174	4.61	5.80

[a] These are mean errors and root mean square errors; as indicators of fit, percentage errors in these cases may be misleading.

FIGURE II 3.6 COMMERCIAL INVENTORIES OF EVAPORATED MILK

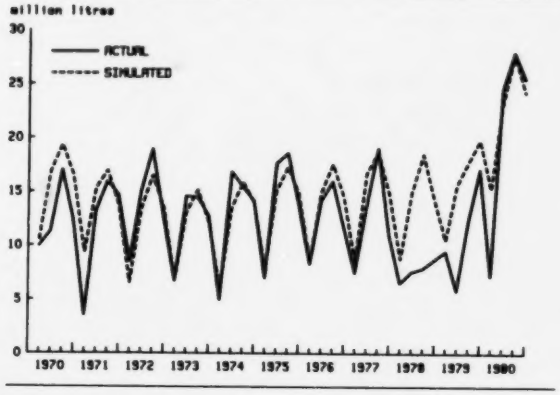


FIGURE II 3.7 RETAIL PRICE INDEX OF BUTTER

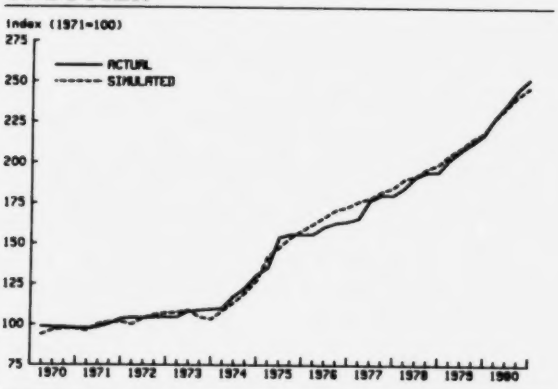


FIGURE II 3.8 GROSS TARGET RETURN FOR INDUSTRIAL MILK

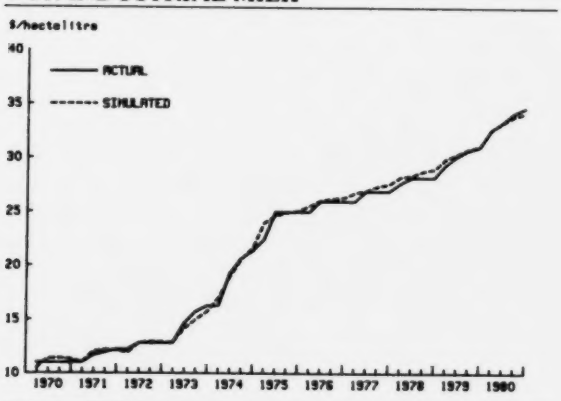
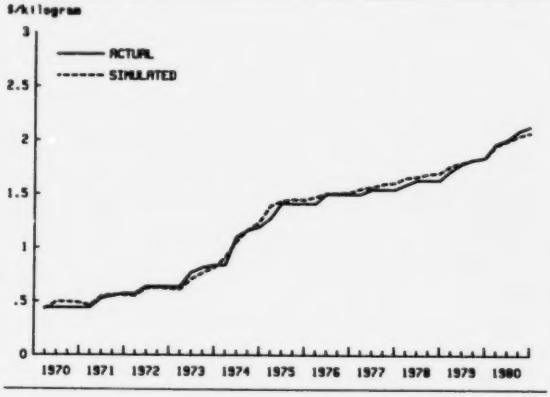


FIGURE II 3.9 SUPPORT PRICE FOR SKIM MILK POWDER



The simulation results for the intra-sample period indicate a reasonably good tracking ability for major items. There are numerous exceptions, and these require comment as they indicate the weaknesses in the model. Within sample, the model has considerable difficulty with inventories of, and net trade in milk products. This difficulty is not surprising since these items exhibit considerable variance. The model also has difficulty in tracking inventories of dairy heifers and shipments of farm-separated cream; substantially better specifications appear to be required for these two items. Another problem concerns the disappearance of evaporated milk and skim milk powder for which the simulated values poorly fits the data. These two equations need improved specifications although the nature of the data adds to the difficulty of the task. Finally, for all policy instruments, the model solves satisfactorily, most of RMSE are less than 5 percent.

Table II 3.3 also lists statistics which illustrate the model ability to track immediately outside the sample period. Again, the results are generally satisfactory, but point to a number of problems, which will require attention. Of particular concern are the errors made in predicting some retail prices. The extra-sample simulation results indicate specific problems with the use of the price of blended crude oil as an input price for the processing industry. This variable has experienced steep increases during the last two years, especially during 1981. Consequently, retail prices whose specification used that factor, have been over-predicted. Another price, more representative of the general energy cost encountered by the processing sector has to be included. This problem could as well explain part of the demand block inaccuracies.

II 3.8 Assessment

II 3.8.1 Application of the dairy component

The dairy component can be used, on a limited basis, for forecasting and policy analysis. The component may be used by itself for work specifically concerned with the dairy sector, or as part of the agricultural sector model, for studies dealing with inter-sectoral relationships. These are some applications in which the component will be particularly reliable, and hence useful, and some in which it will be particularly weak. These applications must be identified since they point to others where the current version can be used effectively, as well as to the required direction of future work. As demonstrated in Section II 3.7 the component's ability to forecast major items of industry activity appears quite respectable. In a forecasting mode, the policy variables in the policy block may also be treated all exogenously, depending on the purpose of the forecast and on the availability of information on the future course of these policies.

II 3.8.2 Future work

Future work with specific hypothesis testing and alternative estimation procedures is outlined in Part I, *Overview*. There remains, however, considerable work to be done in refining the current dairy component's specification and coverage. Immediate work is required on the specifications as outlined in Sections II 3.7.

Part of the future plans is the respecification of the cheese equations. The disaggregation of the factory cheese into cheddar and specialty cheese will allow the representation of the different movements in consumption and production of these two cheese categories. Hopefully a better fit in the equations will provide more accuracy to the forecast besides the extra information on the cheese industry.

Dairy policy evolves through time and when changes occur, they have to be reflected in the model. In order to make it more representative and to improve its forecasting performance as well as to keep up with a changing world, the dairy component is frequently revised and any modification to this version will be reported in the next technical bulletin. However, if one is interested in a more up-to-date version of the dairy component, he (or she) can contact the author.

II 3.9 Notes and bibliography

II 3.9.1 Notes

1. See for example, *Orientation of Canadian Agriculture: A Task Force Report*, Vol. I, Part B, Agriculture Canada, 1977.
2. The data here are taken from issues of the *Dairy Review*, Statistics Canada, Catalogue No. 23-001.
3. This estimate somewhat overstates productivity growth. It has been computed from data on total milk production and numbers of cows milked as published in the *Dairy Review*. Since many small producers have left the industry, particularly small cream shippers, the change in average farm efficiency affects this estimate of milk yield per cow.
4. A number of factors caused by the exit of dairy producers from the industry between 1970 and 1975, namely was beef prices, the low price of milk relative to prices of products competing for the same resources, and government incentives to small producers to leave the industry. The transfer to beef operations was consequently very high and may not occur to such a degree again.
5. While these two sources adequately discuss government policy instruments, a thorough understanding of this very complicated area can only be attained by the additional reading of the annual reports of the Canadian Dairy Commission and provincial marketing organizations.
6. This agreement is knows as the "Interim Comprehensive Milk Marketing Plan", which was signed initially by Ontario and Quebec on January 14, 1971.
7. Before 1967, federal government activities in the dairy industry were handled by the Agriculture Stabilization Board.
8. Although over-quota levies were to be charged for milk over quota after 1970, quotas were not seriously binding until 1976. From 1970 to 1976 producers who were over quota before the end of the dairy year either were issued a temporary quota, or were refunded the full amount of any over-quota levy paid during the year.

9. In Ontario, plants processing Cheddar cheese, and butter and skim milk powder (class 5 and 5a milk) have plant supply quotas. This system ensures that requirements for milk classes 1 to 4 are fully met, but it also entails that the normal arbitrage mechanism for distributing milk among competing uses is subsumed by plant supply quotas for class 5 and 5a milk.
10. Dynamic multipliers, including the impact, interim, and long-term multipliers, will provide intricate detail about the responsiveness of the industry to exogenous shocks. See plans for future work set out in Part I, *Overview*.
11. See for comparison, *Food and Agriculture Regional Model*, Part II 3 *Dairy Products*, Agriculture Canada, March 1980.

II 3.9.2 Bibliography

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II 3.10 Appendix

II 3.10.1 Appendix A — List of variables and equations

MODEL: DAIRY

SYMBOL DECLARATIONS

ENDOGENOUS:

CICB3	- COMMERCIAL CLOSING INVENTORY OF BUTTER, CANADA (MIL. KG)
CIEM3	- COMMERCIAL CLOSING INVENTORY OF EVAPORATED WHOLE MILK, CANADA (MIL. L)
CIFC3	- COMMERCIAL CLOSING INVENTORY OF CHEESE, CANADA (MIL. KG)
CIPM3	- COMMERCIAL CLOSING INVENTORY OF SKIM MILK POWDER, CANADA (MIL. KG)
CRDY3	- FARM CASH RECEIPTS FROM DAIRY, CANADA ($MIL.)
DCB3	- DISAPPEARANCE OF CREAMERY BUTTER, CANADA (MIL. KG)
DCRM3	- DISAPPEARANCE OF ALL CREAMS IN MILK EQ, CANADA (MIL. L)
DEM3	- DISAPPEARANCE OF EVAPORATED WHOLE MILK, CANADA (MIL. L)
DFC3	- DISAPPEARANCE OF FACTORY CHEESE, CANADA (MIL. KG)
DIC3	- DISAPPEARANCE OF ICE CREAM, CANADA (MIL. L)
DLM3	- DISAPPEARANCE OF LOW FAT MILK, CANADA (MIL. L)
DMS3	- DISAPPEARANCE OF STANDARD MILK, CANADA (MIL. L)
DPM3	- DISAPPEARANCE OF SKIM MILK POWDER, CANADA (MIL. KG)
EXSMP3	- EXPORTS OF SKIM MILK POWDER, CANADA (MIL. KG)
GICB3	- GOVERNMENT CLOSING INVENTORIES OF BUTTER, CANADA (MIL. KG)
GIPM3	- GOVERNMENT CLOSING INVENTORIES OF SKIM MILK POWDER, CANADA (MIL. KG)
IDC3	- CLOSING INVENTORY OF DAIRY COWS, CANADA ('000)
IDH3	- CLOSING INVENTORY OF DAIRY HEIFERS, CANADA ('000)
NTCB3	- NET TRADE IN BUTTER, CANADA (MIL. KG)
NTTC3	- NET TRADE IN CHEESE, CANADA (MIL. KG)
PCCB3	- PER CAPITA DISAPPEARANCE OF BUTTER, CANADA (KG)
PCCRM3	- PER CAPITA DISAPPEARANCE OF CREAMS IN MILK EQ, CANADA (L)
PCEM3	- PER CAPITA DISAPPEARANCE OF EVAPORATED WHOLE MILK, CANADA (L)
PCFC3	- PER CAPITA DISAPPEARANCE OF FACTORY CHEESE, CANADA (KG)
PCIC3	- PER CAPITA DISAPPEARANCE OF ICE CREAM, CANADA (L)
PCLM3	- PER CAPITA DISAPPEARANCE OF LOW FAT FLUID MILK, CANADA (L)
PCMS3	- PER CAPITA DISAPPEARANCE OF STANDARD FLUID MILK, CANADA (L)
QCB3	- PRODUCTION OF BUTTER, CANADA (MIL. KG)
QEM3	- PRODUCTION OF EVAPORATED WHOLE MILK, CANADA (MIL. L)
QFC3	- PRODUCTION OF FACTORY CHEESE, CANADA (MIL. KG)
QIC3	- PRODUCTION OF ICE CREAM, CANADA (MIL. L)
QPM3	- PRODUCTION OF SKIM MILK POWDER, CANADA (MIL. KG)
RPCB3	- CPI FOR BUTTER, CANADA (1971=100)
RPDP3	- CPI FOR DAIRY PRODUCTS, CANADA (1971=100)
RPEM3	- CPI FOR EVAPORATED MILK, CANADA (1971=100)
RPFM3	- CPI FOR FLUID MILKS, CANADA (1971=100)
RPIC3	- CPI FOR ICE CREAM, CANADA (1971=100)
RPMG3	- CPI FOR MARGARINE, CANADA (1971=100)
RPPC3	- CPI FOR PROCESSED CHEESE, CANADA (1971=100)
RPPM3	- CPI FOR SKIM MILK POWDER, CANADA (1971=100)
SFSC3	- SHIPMENTS OF FARM SEPARATED CREAM, CANADA (MIL. HL)
SMFP3	- SUPPLY OF MILK FOR FLUID PURPOSES, CANADA (MIL. HL)
SMKC3	- SHIPMENTS OF MILK AND CREAM OFF FARMS, CANADA (MIL. HL)
SMMC3	- SHIPMENTS OF INDUSTRIAL MILK, CANADA (MIL. HL)
SPC3	- MILK SHIPMENTS PER COW, CANADA (HL/COW)
SSOC3	- SUPPLY OF SKIM OFF CREAM FROM FLUID MILK PROCESSING, CANADA (MIL. HL)

WPCH3 - WHOLESALE PRICE OF CHEDDAR CHEESE (BELLEVILLE), CANADA ($/KG)
WPEM3 - INDUSTRIAL SELLING PRICE INDEX FOR EVAPORATED MILK, CANADA (1971=100)
WPIC3 - INDUSTRIAL SELLING PRICE INDEX FOR ICE CREAM, CANADA (1971=100)
XAPM3 - ASSUMED DAIRY PROCESSING PLANT MARGINS, CANADA ($/HL)
XDCC12 - DAIRY CASH COST INDEX, EASTERN CANADA (1971=100)
XFTM3 - DAIRY TARGET RETURN FORMULA, CANADA ($/HL)
XGTM3 - GROSS TARGET RETURNS FOR INDUSTRIAL MILK, CANADA ($/HL)
XMREQ3 - INDUSTRIAL MILK REQUIREMENTS, CANADA (MIL. HL)
XNTM3 - NET TARGET RETURN FOR INDUSTRIAL MILK, CANADA ($/HL)
XPFM3 - AVERAGE FARM PRICE FOR FLUID MILK, CANADA ($/HL)
XPMOQ3 - NET PRICE FOR OVER QUOTA MILK, CANADA ($/HL)
XQM3 - NAIVE CONCEPT, FLUID AND INDUSTRIAL MILK QUOTA, CANADA (MIL. HL)
XWPCB3 - WHOLESALE SUPPORT PRICE OF BUTTER, CANADA ($/KG)
XWPPM3 - WHOLESALE SUPPORT PRICE OF SKIM MILK POWDER, CANADA ($/KG)

EXOGENOUS:
CPI3 - CPI FOR ALL ITEMS, CANADA (1971=100)
D1975 - DUMMY VARIABLE TO CAPTURE CHANGE IN DAIRY DATA REPORTING
D1976 - DUMMY VARIABLE TO REFLECT CONSTRAINING QUOTA REGIME
D8081 - DUMMY VARIABLE TO CAPTURE EFFECTS OF BUTTER ADVERTISING, CANADA
ER34 - CANADA - U.S.A. EXCHANGE RATE ($CAN./$U.S.A.)
EXEM3 - EXPORTS OF EVAPORATED WHOLE MILK, CANADA (MIL. L)
EXPPM3 - EXPORT PRICE OF SKIM MILK POWDER, CANADA ($/KG)
FPDR2 - PRICE INDEX FOR DAIRY RATION, EASTERN CANADA (1971=100)
JS1 - SEASONAL DUMMY, FIRST QUARTER
JS2 - SEASONAL DUMMY, SECOND QUARTER
JS3 - SEASONAL DUMMY, THIRD QUARTER
JS4 - SEASONAL DUMMY, FOURTH QUARTER
NTFC3 - NET TRADE IN FACTORY CHEESE, CANADA (MIL. KG)
NTPC3 - NET TRADE IN PROCESSED CHEESE, CANADA (MIL. KG)
PBOIL3 - BLENDED PRICE OF CRUDE OIL, CANADA ($/BBL)
PCDY3 - PER CAPITA DISPOSABLE INCOME, CANADA ($)
PHF2 - PRICE OF SLAUGHTER HEIFERS (A1,2), TORONTO ($/CWT)
POPN3 - POPULATION OF CANADA (MIL.)
PSL4 - PRICE OF SOYBEAN OILS, U.S.A. ($/TON)
QODP3 - PRODUCTION OF OTHER MILK PRODUCTS (YOGURT, ETC.), CANADA (MIL. HL)
RPBF3 - CPI FOR BEEF, CANADA (1971=100)
RPHC3 - CPI FOR HOME CONFECTIONS, CANADA (1971=100)
TIME - LINEAR TREND VARIABLE
TIMEB - TIME TREND - CONSTANT AFTER 1978 Q1
WA3 - AVERAGE WEEKLY EARNINGS - INDUSTRIAL COMPOSITE, CANADA ($)
XCSUM3 - CONSUMER SUBSIDY ON FLUID MILK (DUMMY FROM 1973 4 TO 1974 3), CANADA
XCSUP3 - CONSUMER SUBSIDY ON SKIM MILK POWDER, CANADA ($/KG)
XDCIXFD2 - DAIRY CASH COST INDEX EXCLUDING FEED, EASTERN CANADA (1971=100)
XIQH3 - IN-QUOTA HOLDBACK ON INDUSTRIAL MILK, CANADA ($/HL)
XMRES3 - RESIDUAL FROM INDUSTRIAL MILK SUPPLY AND UTILIZATION, CANADA (MIL. HL)
XPNM3 - OVER QUOTA PENALTY FOR INDUSTRIAL MILK, CANADA ($/HL)
XSEQ3 - SUBSIDY ELIGIBILITY QUOTA, CANADA (MIL. HL)
XSUM3 - DIRECT PRODUCER SUBSIDY ON INDUSTRIAL MILK, CANADA ($/HL)
YHY3 - YIELD OF HAY, CANADA (T/HC)

COEFFICIENT:
CICB3.0 CICB3.1 CICB3.2 CICB3.3 CICB3.4 CICB3.5 CICB3.6 CIEM3.0 CIEM3.1 CIEM3.2
CIEM3.3 CIEM3.4 CIEM3.5 CIEM3.6 CIPM3.0 CIPM3.1 CIPM3.2 CIPM3.3 CIPM3.4 CIPM3.5
CIPM3.6 CRDY3.0 CRDY3.1 CRDY3.2 CRDY3.3 CRDY3.4 CRDY3.5 DPM3.0 DPM3.1 DPM3.2
DPM3.3 DPM3.4 DPM3.5 DPM3.6 EXSMP3.0 EXSMP3.1 EXSMP3.2 IDC3.0 IDC3.1 IDC3.2

```
IDC3.3  IDC3.4  IDH3.0  IDH3.1  IDH3.2  IDH3.3  NTCB3.0  NTCB3.1  NTCB3.2  NTCB3.3
NTCB3.4  NTCB3.5  PCCB3.0  PCCB3.1  PCCB3.2  PCCB3.3  PCCB3.4  PCCB3.5  PCCB3.6
PCCRM3.0  PCCRM3.1  PCCRM3.2  PCCRM3.3  PCCRM3.4  PCCRM3.5  PCCRM3.6  PCCRM3.7  PCEM3.0
PCEM3.1  PCEM3.2  PCEM3.3  PCEM3.4  PCEM3.5  PCEM3.6  PCFC3.0  PCFC3.1  PCFC3.2  PCFC3.3
PCFC3.4  PCFC3.5  PCFC3.6  PCIC3.0  PCIC3.1  PCIC3.2  PCIC3.3  PCIC3.4  PCIC3.5  PCIC3.6
PCLM3.0  PCLM3.1  PCLM3.2  PCLM3.3  PCLM3.4  PCLM3.5  PCLM3.6  PCLM3.7  PCMS3.0  PCMS3.1
PCMS3.2  PCMS3.3  PCMS3.4  PCMS3.5  PCMS3.7  PCMS3.8  QFC3.0  QFC3.1  QFC3.2  QFC3.3
QFC3.4  QFC3.5  QFC3.6  QPM3.0  QPM3.1  QPM3.2  QPM3.3  QPM3.4  QPM3.5  RPCB3.0  RPCB3.1
RPCB3.2  RPCB3.3  RPDP3.1  RPEM3.0  RPEM3.1  RPEM3.2  RPEM3.3  RPFM3.0  RPFM3.1  RPFM3.2
RPFM3.3  RPFM3.4  RPFM3.5  RPFM3.6  RPFM3.7  RPIC3.0  RPIC3.1  RPIC3.2  RPIC3.3  RPIC3.4
RPIC3.5  RPIC3.6  RPIC3.7  RPMG3.0  RPMG3.1  RPMG3.2  RPMG3.3  RPMG3.4  RPPC3.0  RPPC3.1
RPPC3.2  RPPC3.4  RPPM3.0  RPPM3.1  RPPM3.2  RPPM3.3  SFSC3.0  SFSC3.1  SFSC3.2  SFSC3.3
SFSC3.4  SFSC3.5  SFSC3.6  SFSC3.7  SMFP3.0  SMFP3.1  SMFP3.2  SMFP3.3  SMFP3.4  SMFP3.5
SPC3.A  SPC3.B  SPC3.C  SPC3.0  SPC3.1  SPC3.2  SPC3.3  SPC3.4  SPC3.5  SPC3.6  SPC3.7
SPC3.8  SPC3.9  SSOC3.0  SSOC3.1  SSOC3.2  SSOC3.3  WPCH3.0  WPCH3.1  WPCH3.2  WPCH3.3
WPEM3.0  WPEM3.1  WPEM3.2  WPEM3.3  WPIC3.0  WPIC3.1  WPIC3.2  WPIC3.3  WPIC3.4  WPIC3.5
WPIC3.6  XAPM3.0  XAPM3.1  XAPM3.2  XGTM3.0  XGTM3.1  XGTM3.2  XGTM3.3  XGTM3.4  XGTM3.5
XPFM3.0  XPFM3.1  XPFM3.2  XPFM3.3  XPFM3.4  XPFM3.5  XWPPM3.0  XWPPM3.1  XWPPM3.2
XWPPM3.3
```

EQUATIONS

SHIPMENTS OF INDUSTRIAL MILK AND CREAM:

```
1:      SMMC3 = SMKC3-SMFP3
```

NAIVE CONCEPT OF FLUID AND INDUSTRIAL MILK QUOTA:

```
2:      XQM3 = XSEQ3+SMFP3(-1)+SMFP3(-2)+SMFP3(-3)+SMFP3(-4)
```

TOTAL SHIPMENTS OF MILK AND CREAM:

```
3:      SMKC3 = (IDC3+IDC3(-1))/2000*SPC3
```

AVERAGE SHIPMENT PER COW:

```
4:      SPC3 = SPC3.0+SPC3.1*JS1+SPC3.2*JS2+SPC3.3*JS3+SPC3.4*LOG(XNTM3(-1))+SPC3.5*
        LOG(FPDR2(-1))+SPC3.6*LOG(YHY3)+SPC3.7*LOG(SPC3(-1))+(SPC3.8+SPC3.9*JS1+
        SPC3.A*JS2+SPC3.B*JS3)*LOG(TIME)+SPC3.C*LOG(XPMOQ3(-1))
```

INVENTORY OF DAIRY COWS:

```
5:      IDC3 = IDC3.0+(IDC3.1+IDC3.2*D1976)*XQM3/(SPC3(-1)+SPC3(-2)+SPC3(-3)+SPC3(-4)
        )+IDC3.3*IDC3(-2)+(IDC3.4-IDC3.4*D1976)*XNTM3(-1)/FPDR2(-1)
```

INVENTORY OF DAIRY HEIFERS:

```
6:      IDH3 = IDH3.0+IDH3.1*(IDC3(-4)+IDC3(-5)+IDC3(-6)+IDC3(-7))+IDH3.2*PHF2(-1)+
        IDH3.3*XNTM3
```

SHIPMENTS OF FARM SEPARATED CREAM:

```
7:      SFSC3 = SFSC3.0+SFSC3.1*JS1+SFSC3.2*JS2+SFSC3.3*JS3+SFSC3.4*XWPCB3(-1)+(
        SFSC3.5+SFSC3.6*LOG(TIME))*SMKC3+SFSC3.7*XWPPM3(-1)
```

SUPPLY OF SKIM OFF CREAM:

```
8:      SSOC3 = SSOC3.0+SSOC3.1*DCRM3+SSOC3.2*DLM3+SSOC3.3*DMS3
```

SHIPMENTS OF MILK FOR FLUID PURPOSES:

```
9:      SMFP3 = SMFP3.0+SMFP3.1*DLM3+SMFP3.2*DMS3+SMFP3.3*D1975+SMFP3.4*DCRM3+SMFP3.5
        *SMFP3(-1)
```

```
   PRODUCTION OF FACTORY CHEESE:
10:        QFC3 = QFC3.0+QFC3.1*JS1+QFC3.2*JS2+QFC3.3*JS3+QFC3.4*MPCH3+QFC3.5*(4.32*
           XWPCB3+8.24*XWPPM3)+QFC3.6*QFC3(-1)

   PRODUCTION OF ICE CREAM:
11:        QIC3 = DIC3

   PRODUCTION OF EVAPORATED WHOLE MILK:
12:        QEM3 = CIEM3-CIEM3(-1)+EXEM3+DEM3

   PRODUCTION OF CREAMERY BUTTER:
13:        QCB3 = (SMMC3+SSOC3-XMRES3-0.1068*QFC3-0.0239*QEM3-0.0165*QIC3-QODP3)/0.2273

   PRODUCTION OF SKIM MILK POWDER:
14:        QPM3-QPM3(-1) = QPM3.0+QPM3.1*JS1+QPM3.2*JS2+QPM3.3*JS3+QPM3.4*(QCB3-QCB3(-1)
           )+QPM3.5*(SFSC3+SSOC3-SFSC3(-1)-SSOC3(-1))

   COMMERCIAL INVENTORIES OF FACTORY CHEESE:
15:        CIFC3 = QFC3+CIFC3(-1)-DFC3-NTFC3

   COMMERCIAL INVENTORIES OF EVAPORATED WHOLE MILK:
16:        CIEM3 = CIEM3.0+CIEM3.1*JS1+CIEM3.2*JS2+CIEM3.3*JS3+CIEM3.4*QEM3+CIEM3.5*(
           DEM3-SUM(I = -4 TO -1 : DEM3(I))/4)+CIEM3.6*CIEM3(-1)

   COMMERCIAL INVENTORIES OF CREAMERY BUTTER:
17:        CICB3 = CICB3.0+CICB3.1*JS1+CICB3.2*JS2+CICB3.3*JS3+CICB3.4*QCB3+CICB3.5*(
           XWPCB3-XWPCB3(-1))+CICB3.6*DCB3

   GOVERNMENT (CDC) INVENTORIES OF CREAMERY BUTTER:
18:        GICB3 = QCB3+GICB3(-1)+CICB3(-1)-DCB3-NTCB3-CICB3

   GOVERNMENT (CDC) INVENTORIES OF SKIM MILK POWDER:
19:        GIPM3 = QPM3+CIPM3(-1)+GIPM3(-1)-DPM3-CIPM3-EXSMP3

   COMMERCIAL INVENTORIES OF SKIM MILK POWDER:
20:        CIPM3 = CIPM3.0+CIPM3.1*JS1+CIPM3.2*JS2+CIPM3.3*JS3+(CIPM3.4+CIPM3.5*TIME)*
           QPM3+CIPM3.6*(XWPPM3-XWPPM3(-1))

   NET TRADE IN CREAMERY BUTTER:
21:        NTCB3 = NTCB3.0+NTCB3.1*JS1+NTCB3.2*JS2+NTCB3.3*JS3+NTCB3.4*GICB3(-1)+NTCB3.5
           *NTCB3(-1)

   EXPORTS OF SKIM MILK POWDER:
22:        EXSMP3 = EXSMP3.0+EXSMP3.1*(GIPM3(-1)+CIPM3(-1))+EXSMP3.2*EXSMP3(-1)

   NET TRADE IN TOTAL CHEESE:
23:        NTTC3 = NTFC3+NTPC3

   CONSUMER PRICE INDEX FOR STANDARD MILK:
24:        RPFM3 = RPFM3.0+RPFM3.1*XPFM3+RPFM3.2*(XPFM3-XPFM3(-1))+RPFM3.3*XCSUM3+
           RPFM3.4*(DMS3+DLM3-DMS3(-1)-DLM3(-1))+RPFM3.5*WA3+RPFM3.6*PBOIL3+RPFM3.7*
           RPFM3(-1)

   CONSUMER PRICE INDEX FOR ICE CREAM:
25:        RPIC3 = RPIC3.0+RPIC3.1*JS1+RPIC3.2*JS2+RPIC3.3*JS3+RPIC3.4*WPIC3+RPIC3.5*
           WPIC3(-1)+RPIC3.6*PBOIL3+RPIC3.7*RPIC3(-1)
```

```
   CONSUMER PRICE INDEX FOR CREAMERY BUTTER:
26:        RPCB3 = RPCB3.0+RPCB3.1*XWPCB3+RPCB3.2*PBOIL3+RPCB3.3*RPCB3(-1)

   CONSUMER PRICE INDEX FOR MARGARINE:
27:        RPMG3 = RPMG3.0+RPMG3.1*PSL4(-1)+RPMG3.2*RPCB3+RPMG3.3*RPMG3(-1)+RPMG3.4*ER34
           (-1)

   CONSUMER PRICE INDEX FOR PROCESS CHEESE:
28:        RPPC3 = RPPC3.0+RPPC3.1*WPCH3+RPPC3.2*(WPCH3-WPCH3(-1))+RPPC3*ER34+RPPC3.4*
           RPPC3(-1)

   CONSUMER PRICE INDEX FOR SKIM MILK POWDER:
29:        RPPM3 = RPPM3.0+RPPM3.1*(XWPPM3-XCSUP3/100)+RPPM3.2*PBOIL3+RPPM3.3*RPPM3(-1)

   CONSUMER PRICE INDEX FOR EVAPORATED MILK:
30:        RPEM3 = RPEM3.0+RPEM3.1*WPEM3+RPEM3.2*PBOIL3+RPEM3.3*RPEM3(-1)

   WHOLESALE PRICE FOR CHEDDAR CHEESE:
31:        WPCH3 = WPCH3.0+WPCH3.1*(4.32*XWPCB3+8.24*XWPPM3)+WPCH3.2*CIFC3(-1)/DFC3(-1)+
           WPCH3.3*WPCH3(-1)

   WHOLESALE PRICE FOR ICE CREAM:
32:        WPIC3 = WPIC3.0+WPIC3.1*JS1+WPIC3.2*JS2+WPIC3.3*JS3+WPIC3.4*(4.32*XWPCB3+8.24
           *XWPPM3)+WPIC3.5*WPIC3(-1)+WPIC3.6*DIC3

   WHOLESALE PRICE FOR EVAPORATED MILK:
33:        WPEM3 = WPEM3.0+WPEM3.1*(4.32*XWPCB3+8.24*XWPPM3)+WPEM3.2*CIEM3(-1)+WPEM3.3*
           WPEM3(-1)

   PER CAPITA DEMAND FOR STANDARD MILK:
34:        PCMS3 = PCMS3.0+PCMS3.1*JS1+PCMS3.2*JS2+PCMS3.3*JS3+PCMS3.4*RPFM3+PCMS3.5*
           RPEM3+PCMS3.7*LOG(TIMEB)+PCMS3.8*PCMS3(-1)

   PER CAPITA DEMAND FOR LOW FAT MILK:
35:        PCLM3 = PCLM3.0+PCLM3.1*JS1+PCLM3.2*JS2+PCLM3.3*JS3+PCLM3.4*LOG(RPFM3)+
           PCLM3.5*LOG(RPPM3)+PCLM3.6*LOG(PCDY3)+PCLM3.7*LOG(TIME)

   PER CAPITA DEMAND FOR ALL CREAMS:
36:        PCCRM3 = PCCRM3.0+PCCRM3.1*JS1+PCCRM3.2*JS2+PCCRM3.3*JS3+PCCRM3.4*LOG(RPFM3)+
           PCCRM3.5*LOG(PCDY3)+PCCRM3.6*LOG(PCCRM3(-1))+PCCRM3.7*LOG(TIMEB)

   PER CAPITA DEMAND FOR CREAMERY BUTTER:
37:        LOG(PCCB3) = PCCB3.0+PCCB3.1*JS1+PCCB3.2*JS2+PCCB3.3*JS3+PCCB3.4*LOG(RPCB3)+
           PCCB3.5*LOG(TIMEB)+0.3*LOG(RPMG3)+(-PCCB3.4-0.3)*LOG(PCDY3)+PCCB3.6*D8081

   PER CAPITA DEMAND FOR FACTORY CHEESE:
38:        PCFC3 = PCFC3.0+PCFC3.1*LOG(RPPC3)+(PCFC3.2+PCFC3.3*JS1+PCFC3.4*JS2+PCFC3.5*
           JS3)*LOG(PCDY3)+PCFC3.6*LOG(RPBF3)

   PER CAPITA DEMAND FOR ICE CREAM:
39:        PCIC3 = PCIC3.0+PCIC3.1*JS1+PCIC3.2*JS2+PCIC3.3*JS3+PCIC3.4*LOG(RPIC3)+
           PCIC3.5*LOG(RPHC3)+PCIC3.6*LOG(PCDY3)

   PER CAPITA DEMAND FOR EVAPORATED WHOLE MILK:
40:        PCEM3 = PCEM3.0+PCEM3.1*JS1+PCEM3.2*JS2+PCEM3.3*JS3+PCEM3.4*LOG(RPEM3)+
           PCEM3.5*LOG(PCDY3)+PCEM3.6*LOG(TIME)
```

```
   DISAPPEARANCE OF SKIM MILK POWDER:
41:        DPM3 = DPM3.0+DPM3.1*RPPM3+DPM3.2*RPFM3+DPM3.3*PCDY3*POPN3+DPM3.4*DPM3(-1)+
           DPM3.5*DPM3(-2)+DPM3.6*TIME

   INDUSTRIAL MILK REQUIREMENTS:
42:        XMREQ3 = 0.2273*DCB3+0.1068*DFC3+0.0239*DEM3+0.0165*DIC3+XMRES3+QODP3+0.1068*
           NTFC3-SSOC3

   DAIRY CASH COST INDEX:
43:        XDCCI2 = 0.301107*FPDR2+XDCIXFD2

   DAIRY TARGET RETURN FORMULA:
44:        XFTM3 = 0.45*25/166.9*XDCCI2+0.35*25/130.5*CPI3+0.2*25

   GROSS TARGET RETURNS:
45:        XGTM3 = (1-D1975)*(XGTM3.0+XGTM3.1*JS1+XGTM3.2*JS2+XGTM3.3*JS3+XGTM3.4*XFTM3(
           -2)+XGTM3.5*XGTM3(-1))+D1975*(JS1*XFTM3(-2)+JS2*XFTM3(-2)+JS3*(0.667*XFTM3(-2
           )+0.333*XFTM3(-3))+JS4*XFTM3(-3))

   ASSUMED DAIRY PROCESSING PLANT MARGINS:
46:        XAPM3 = XAPM3.0+XAPM3.1*(4.32*XWPCB3+8.24*XWPPM3)+XAPM3.2*XAPM3(-1)

   NET TARGET RETURNS:
47:        XNTM3 = XGTM3-XIQH3

   PRICE OF OVER-QUOTA INDUSTRIAL MILK:
48:        XPMOQ3 = XGTM3-XSUM3-XPNM3

   WHOLESALE SUPPORT PRICE FOR SKIM MILK POWDER:
49:        XWPPM3 = IF XGTM3-XGTM3(-1) EQ 0 THEN XWPPM3(-1) ELSE XWPPM3.0+XWPPM3.1*XGTM3
           +XWPPM3.2*EXPPM3+XWPPM3.3*GIPM3(-1)

   WHOLESALE SUPPORT PRICE FOR CREAMERY BUTTER:
50:        XWPCB3 = (XGTM3-(XSUM3+XWPPM3*8.24)+XAPM3)/4.32

   AVERAGE FARM PRICE OF FLUID MILK:
51:        XPFM3 = XPFM3.0+XPFM3.1*JS1+XPFM3.2*JS2+XPFM3.3*JS3+XPFM3.4*XDCCI2(-2)+
           XPFM3.5*XPFM3(-1)

   DISAPPEARANCE OF STANDARD FLUID MILK:
52:        DMS3 = PCMS3*POPN3

   DISAPPEARANCE OF LOW FAT FLUID MILK:
53:        DLM3 = PCLM3*POPN3

   DISAPPEARANCE OF ALL CREAMS:
54:        DCRM3 = PCCRM3*POPN3

   DISAPPEARANCE OF CREAMERY BUTTER:
55:        DCB3 = PCCB3*POPN3

   DISAPPEARANCE OF FACTORY CHEESE:
56:        DFC3 = PCFC3*POPN3
```

```
   DISAPPEARANCE OF EVAPORATED WHOLE MILK:
57:        DEM3 = PCEM3*POPN3

   DISAPPEARANCE OF ICE CREAM:
58:        DIC3 = PCIC3*POPN3

   CONSUMER PRICE INDEX FOR DAIRY PRODUCTS:
59:        LOG(RPDP3/RPDP3(-1)) = RPDP3.1*(1.15*LOG(RPFM3/RPFM3(-1))+0.22*LOG(RPCB3/
           RPCB3(-1))+0.35*LOG(RPPC3/RPPC3(-1))+0.03*LOG(RPFM3/RPFM3(-1))+0.05*LOG(RPEM3
           /RPEM3(-1))+0.14*LOG(RPIC3/RPIC3(-1)))/2.31

   FARM CASH RECEIPTS FROM DAIRY:
60:        CRDY3 = CRDY3.0+CRDY3.1*XPFM3*SMFP3+(CRDY3.2+CRDY3.3*JS1+CRDY3.4*JS2+CRDY3.5*
           JS3)*XNTM3*SMMC3
```

II 3.10.2 Appendix B — Estimation results

```
4:  SPC3 = SPC3.0+SPC3.1*JS1+SPC3.2*JS2+SPC3.3*JS3+SPC3.4*LOG(XNTM3(-1))+SPC3.5*LOG(FPDR2(-1))+
SPC3.6*LOG(YHY3)+SPC3.7*LOG(SPC3(-1))+(SPC3.8+SPC3.9*JS1+SPC3.A*JS2+SPC3.B*JS3)*LOG(TIME)+SPC3.C*
LOG(XPMOQ3(-1))


NOB = 44      NOVAR = 13
RANGE =  1970 1 TO 1980 4
RSQ =   0.98777      CRSQ =   0.98304      F(12/31) =   208.647
SER =   0.2246       SSR =    1.564        DW(0) =  1.46      COND(X) =   512.32
LHS MEAN =      9.23143      SR =     -0.00012

COEF          VALUE          ST ER          T-STAT          MEAN

SPC3.0       -4.30328       4.10408        -1.04854        1.00000
SPC3.1       -1.68416       2.42250        -0.69521        0.25000
SPC3.2        9.83664       3.03031         3.24608        0.25000
SPC3.3        6.20948       2.27195         2.73310        0.25000
SPC3.4        2.19602       0.76178         2.88274        2.91264
SPC3.5       -1.30254       0.54816        -2.37619        5.05305
SPC3.6        2.16232       0.88302         2.44878        0.69586
SPC3.7        3.43461       1.19069         2.88456        2.19858
SPC3.8        0.63936       0.93306         0.68523        4.23889
SPC3.9        0.46727       0.54474         0.85778        1.05419
SPC3.A       -1.38859       0.64944        -2.13814        1.05792
SPC3.B       -0.85489       0.53371        -1.60180        1.06158
SPC3.C        0.14085       0.05319         2.64821        1.75841
```

```
5:  IDC3 = IDC3.0+(IDC3.1+IDC3.2*D1976)*XQM3/(SPC3(-1)+SPC3(-2)+SPC3(-3)+SPC3(-4))+IDC3.3*IDC3(-2
)+(IDC3.4-IDC3.4*D1976)*XNTM3(-1)/FPDR2(-1)


NOB = 44      NOVAR = 5
RANGE =  1970 1 TO 1980 4
RSQ =   0.98102      CRSQ =   0.97908      F(4/39) =   504.053
SER =  19.8493       SSR = 15365.800       DW(0) =  1.18      COND(X) =   143.89
LHS MEAN =   1868.43000      SR =      0.00879

COEF          VALUE          ST ER          T-STAT          MEAN

IDC3.0     -141.80800      182.26500        -0.77803        1.00000
IDC3.1       96.40780       59.94000         1.60841        1.77335
IDC3.2       91.43370       31.01580         2.94797        0.78473
IDC3.3        0.89004        0.03802        23.41060     1889.53000
IDC3.4     1401.28000      427.88100         3.27493        0.06121
```

6: IDH3 = IDH3.0+IDH3.1*(IDC3(-4)+IDC3(-5)+IDC3(-6)+IDC3(-7))+IDH3.2*PHF2(-1)+IDH3.3*XNTM3

NOB = 44 NOVAR = 4
RANGE = 1970 1 TO 1980 4
RSQ = 0.66414 CRSQ = 0.63895 F(3/40) = 26.366
SER = 27.4774 SSR = 30200.200 DW(0) = 1.47 COND(X) = 164.04
LHS MEAN = 690.97300 SR = 0.02734

COEF	VALUE	ST ER	T-STAT	MEAN
IDH3.0	-558.05200	266.50600	-2.09396	1.00000
IDH3.1	0.13928	0.02758	5.05025	7716.57000
IDH3.2	-1.02749	0.46010	-2.23318	46.16600
IDH3.3	11.02130	2.81906	3.90958	20.11250

7: SFSC3 = SFSC3.0+SFSC3.1*JS1+SFSC3.2*JS2+SFSC3.3*JS3+SFSC3.4*XWPCB3(-1)+(SFSC3.5+SFSC3.6*LOG(TIME))*SMKC3+SFSC3.7*XWPPM3(-1)

NOB = 44 NOVAR = 8
RANGE = 1970 1 TO 1980 4
RSQ = 0.98198 CRSQ = 0.97848 F(7/36) = 280.325
SER = 0.1093 SSR = 0.430 DW(0) = 1.55 COND(X) = 359.06
LHS MEAN = 1.25354 SR = 0.0004

COEF	VALUE	ST ER	T-STAT	MEAN
SFSC3.0	-0.91553	0.34665	-2.64108	1.00000
SFSC3.1	-0.05571	0.05896	-0.94476	0.25000
SFSC3.2	0.20113	0.15485	1.29885	0.25000
SFSC3.3	0.35792	0.14856	2.40923	0.25000
SFSC3.4	0.77906	0.11044	7.05405	2.13227
SFSC3.5	1.05425	0.09401	11.21440	17.19030
SFSC3.6	-0.23261	0.02572	-9.04481	72.89910
SFSC3.7	-0.67084	0.18770	-3.57396	1.16839

8: SSOC3 = SSOC3.0+SSOC3.1*DCRM3+SSOC3.2*DLM3+SSOC3.3*DMS3

NOB = 44 NOVAR = 4
RANGE = 1970 1 TO 1980 4
RSQ = 0.99933 CRSQ = 0.99928 F(3/40) = 2.00E+04
SER = 6.26E-03 SSR = 1.567E-03 DW(0) = 1.22 COND(X) = 137.89
LHS MEAN = 1.16076 SR = 0.00005

COEF	VALUE	ST ER	T-STAT	MEAN
SSOC3.0	0.00484	0.04932	0.09821	1.00000
SSOC3.1	-0.01053	2.22545E-04	-47.32940	71.27150
SSOC3.2	0.00531	6.83341E-05	77.66870	293.35500
SSOC3.3	0.00127	1.38363E-04	9.15955	275.89900

```
9:  SMFP3 = SMFP3.0+SMFP3.1*DUM3+SMFP3.2*DMS3+SMFP3.3*D1975+SMFP3.4*DCRM3+SMFP3.5*SMFP3(-1)


NOB = 44      NOVAR = 6
RANGE =  1970 1 TO 1980 4
RSQ =    0.99757      CRSQ =    0.99725      F(5/38) =  3120.830
SER =    0.0293       SSR = 3.269E-02       DW(0) =  1.98      COND(X) =   249.82
LHS MEAN =       5.62062      SR =       0.00012

COEF            VALUE           ST ER          T-STAT          MEAN

SMFP3.0       -1.91835         0.37804       -5.07448        1.00000
SMFP3.1        0.00822     4.25236E-04       19.32590      293.35500
SMFP3.2        0.01279     9.63613E-04       13.27060      275.89900
SMFP3.3        0.52576         0.02680       19.61940        0.54545
SMFP3.4        0.00413         0.00105        3.93804       71.27150
SMFP3.5        0.18254         0.04098        4.45441        5.57990


10:  QFC3 = QFC3.0+QFC3.1*JS1+QFC3.2*JS2+QFC3.3*JS3+QFC3.4*WPCH3+QFC3.5*(4.32*XWPCB3+8.24*XWPPM3)
+QFC3.6*QFC3(-1)


NOB = 44      NOVAR = 7
RANGE =  1970 1 TO 1980 4
RSQ =    0.92074      CRSQ =    0.90788      F(6/37) =    71.632
SER =    2.1115       SSR =     164.966      DW(0) =  1.94      COND(X) =    98.25
LHS MEAN =      32.70080      SR =       0.00099

COEF            VALUE           ST ER          T-STAT          MEAN

QFC3.0         4.29563         2.86115        1.50136        1.00000
QFC3.1        -1.27326         1.07368       -1.18589        0.25000
QFC3.2         7.88397         1.37485        5.73441        0.25000
QFC3.3         4.45595         0.90997        4.89682        0.25000
QFC3.4         9.40826         4.77807        1.96905        2.16005
QFC3.5        -0.63888         0.45515       -1.40367       19.35900
QFC3.6         0.54959         0.13978        3.93178       32.17690


14:  QPM3-QPM3(-1) = QPM3.0+QPM3.1*JS1+QPM3.2*JS2+QPM3.3*JS3+QPM3.4*(QCB3-QCB3(-1))+QPM3.5*(SFSC3
+SSOC3-SFSC3(-1)-SSOC3(-1))


NOB = 44      NOVAR = 6
RANGE =  1970 1 TO 1980 4
RSQ =    0.99356      CRSQ =    0.99271      F(5/38) =  1171.850
SER =    1.9866       SSR =     149.970      DW(0) =  2.47      COND(X) =    16.06
LHS MEAN =      -0.43666      SR =      -0.00015
```

COEF	VALUE	ST ER	T-STAT	MEAN
QPM3.0	-7.90926	1.62171	-4.87711	1.00000
QPM3.1	8.67456	1.40948	6.15443	0.25000
QPM3.2	12.22690	3.57213	3.42286	0.25000
QPM3.3	10.24370	1.59841	6.40871	0.25000
QPM3.4	1.88774	0.12831	14.71230	-0.28447
QPM3.5	-12.68190	1.42929	-8.87290	-0.01761

16: CIEM3 = CIEM3.0+CIEM3.1*JS1+CIEM3.2*JS2+CIEM3.3*JS3+CIEM3.4*QEM3+CIEM3.5*(DEM3-SUM(I = -4 TO -1 : DEM3(I))/4)+CIEM3.6*CIEM3(-1)

NOB = 44 NOVAR = 7
RANGE = 1970 1 TO 1980 4
RSQ = 0.80773 CRSQ = 0.77655 F(6/37) = 25.907
SER = 2.5609 SSR = 242.660 DW(0) = 2.06 COND(X) = 15.12
LHS MEAN = 13.02650 SR = 0.00015

COEF	VALUE	ST ER	T-STAT	MEAN
CIEM3.0	-4.74599	2.56846	-1.84779	1.00000
CIEM3.1	-3.68815	1.16342	-3.17009	0.25000
CIEM3.2	6.15768	1.66383	3.70090	0.25000
CIEM3.3	4.04080	1.21434	3.32755	0.25000
CIEM3.4	0.19028	0.06233	3.05253	27.79880
CIEM3.5	-0.37905	0.06676	-5.67818	-0.74778
CIEM3.6	0.82200	0.11123	7.39009	12.86130

17: CICB3 = CICB3.0+CICB3.1*JS1+CICB3.2*JS2+CICB3.3*JS3+CICB3.4*QCB3+CICB3.5*(XWPCB3-XWPCB3(-1)) +CICB3.6*DCB3

NOB = 44 NOVAR = 7
RANGE = 1970 1 TO 1980 4
RSQ = 0.52896 CRSQ = 0.45257 F(6/37) = 6.925
SER = 1.2993 SSR = 62.463 DW(0) = 1.69 COND(X) = 27.78
LHS MEAN = 7.46773 SR = -0.00004

COEF	VALUE	ST ER	T-STAT	MEAN
CICB3.0	7.32847	1.76579	4.15024	1.00000
CICB3.1	0.92845	0.57027	1.62808	0.25000
CICB3.2	-0.27901	1.24269	-0.22452	0.25000
CICB3.3	-2.27349	1.11275	-2.04312	0.25000
CICB3.4	0.14813	0.05577	2.65606	29.29840
CICB3.5	3.40634	3.82867	0.88969	0.04720
CICB3.6	-0.12684	0.06261	-2.02604	31.18380

20: CIPM3 = CIPM3.0+CIPM3.1*JS1+CIPM3.2*JS2+CIPM3.3*JS3+(CIPM3.4+CIPM3.5*TIME)*QPM3+CIPM3.6*(XWPPM3-XWPPM3(-1))

NOB = 44 NOVAR = 7
RANGE = 1970 1 TO 1980 4
RSQ = 0.81231 CRSQ = 0.78188 F(6/37) = 26.690
SER = 2.7403 SSR = 277.849 DW(0) = 1.52 COND(X) = 18.29
LHS MEAN = 16.60280 SR = 0.00022

COEF	VALUE	ST ER	T-STAT	MEAN
CIPM3.0	10.12450	1.69802	5.96254	1.00000
CIPM3.1	-3.18137	1.19629	-2.65935	0.25000
CIPM3.2	-1.99726	2.57726	-0.77495	0.25000
CIPM3.3	-1.04891	2.30520	-0.45502	0.25000
CIPM3.4	0.65769	0.07678	8.56603	36.11130
CIPM3.5	-0.00656	9.29647E-04	-7.05325	2512.84000
CIPM3.6	19.85130	9.82866	2.01973	0.03838

21: NTCB3 = NTCB3.0+NTCB3.1*JS1+NTCB3.2*JS2+NTCB3.3*JS3+NTCB3.4*GICB3(-1)+NTCB3.5*NTCB3(-1)

NOB = 44 NOVAR = 6
RANGE = 1970 1 TO 1980 4
RSQ = 0.52668 CRSQ = 0.4644 F(5/38) = 8.457
SER = 2.3765 SSR = 214.610 DW(0) = 2.02 COND(X) = 9.12
LHS MEAN = -1.29010 SR = 0.00004

COEF	VALUE	ST ER	T-STAT	MEAN
NTCB3.0	-5.95073	1.55513	-3.82652	1.00000
NTCB3.1	2.10753	1.05571	1.99631	0.25000
NTCB3.2	5.33771	1.26848	4.20795	0.25000
NTCB3.3	2.83768	1.14027	2.48860	0.25000
NTCB3.4	0.14189	0.04982	2.84804	18.91270
NTCB3.5	0.45979	0.12796	3.59313	-1.29116

22: EXSMP3 = EXSMP3.0+EXSMP3.1*(GIPM3(-1)+CIPM3(-1))+EXSMP3.2*EXSMP3(-1)

NOB = 44 NOVAR = 3
RANGE = 1970 1 TO 1980 4
RSQ = 0.31222 CRSQ = 0.27867 F(2/41) = 9.306
SER = 10.6659 SSR = 4664.190 DW(0) = 2.14 COND(X) = 5.28
LHS MEAN = 24.50400 SR = 0.00053

COEF	VALUE	ST ER	T-STAT	MEAN
EXSMP3.0	7.93913	4.16915	1.90425	1.00000

EXSMP3.1	0.08170	0.03671	2.22544	59.35710
EXSMP3.2	0.47068	0.12738	3.69503	24.89050

24: RPFM3 = RPFM3.0+RPFM3.1*XPFM3+RPFM3.2*(XPFM3-XPFM3(-1))+RPFM3.3*XCSUM3+RPFM3.4*(DMS3+DLM3-DMS3(-1)-DLM3(-1))+RPFM3.5*WA3+RPFM3.6*PBOIL3+RPFM3.7*RPFM3(-1)

NOB = 44 NOVAR = 8
RANGE = 1970 1 TO 1980 4
RSQ = 0.99936 CRSQ = 0.99924 F(7/36) = 8049.890
SER = 1.3134 SSR = 62.096 DW(0) = 1.68 COND(X) = 145.42
LHS MEAN = 155.17300 SR = 0.00224

COEF	VALUE	ST ER	T-STAT	MEAN
RPFM3.0	4.37083	2.30000	1.90036	1.00000
RPFM3.1	1.88002	0.24657	7.62473	24.03500
RPFM3.2	3.52720	0.59986	5.88006	0.53590
RPFM3.3	-9.15630	0.93520	-9.79076	0.09091
RPFM3.4	-0.09137	0.01804	-5.06513	3.18825
RPFM3.5	0.06274	0.03292	1.90549	209.50600
RPFM3.6	0.46447	0.27362	1.69752	7.86310
RPFM3.7	0.58062	0.06291	9.22988	151.65400

25: RPIC3 = RPIC3.0+RPIC3.1*JS1+RPIC3.2*JS2+RPIC3.3*JS3+RPIC3.4*WPIC3+RPIC3.5*WPIC3(-1)+RPIC3.6*PBOIL3+RPIC3.7*RPIC3(-1)

NOB = 44 NOVAR = 8
RANGE = 1970 1 TO 1980 4
RSQ = 0.9939 CRSQ = 0.99271 F(7/36) = 837.564
SER = 4.2121 SSR = 638.711 DW(0) = 2.18 COND(X) = 120.16
LHS MEAN = 155.08700 SR = 0.0013

COEF	VALUE	ST ER	T-STAT	MEAN
RPIC3.0	40.07830	8.98223	4.46196	1.00000
RPIC3.1	1.27526	1.93398	0.65940	0.25000
RPIC3.2	0.07780	2.05610	0.03784	0.25000
RPIC3.3	-0.16645	1.93235	-0.08614	0.25000
RPIC3.4	0.33404	0.13252	2.52063	178.49900
RPIC3.5	-0.13602	0.11926	-1.14061	173.08500
RPIC3.6	4.37197	1.06829	4.09249	7.86310
RPIC3.7	0.29219	0.15766	1.85324	151.45300

26: RPCB3 = RPCB3.0+RPCB3.1*XWPCB3+RPCB3.2*PBOIL34+RPCB3.3*RPCB3(-1)

NOB = 44 NOVAR = 4
RANGE = 1970 1 TO 1980 4
RSQ = 0.99904 CRSQ = 0.99897 F(3/40) = 1.38E+04
SER = 1.5360 SSR = 94.370 DW(0) = 0.83 COND(X) = 100.57
LHS MEAN = 150.89800 SR = 0.002

COEF	VALUE	ST ER	T-STAT	MEAN
RPCB3.0	6.71264	2.93460	2.28742	1.00000
RPCB3.1	46.51290	3.73388	12.45700	2.17946
RPCB3.2	1.26241	0.37270	3.38723	7.86310
RPCB3.3	0.22308	0.06009	3.71271	147.41700

27: RPMG3 = RPMG3.0+RPMG3.1*PSL4(-1)+RPMG3.2*RPCB3+RPMG3.3*RPMG3(-1)+RPMG3.4*ER34(-1)

NOB = 44 NOVAR = 5
RANGE = 1970 1 TO 1980 4
RSQ = 0.99459 CRSQ = 0.99404 F(4/39) = 1792.840
SER = 4.0570 SSR = 641.922 DW(0) = 1.24 COND(X) = 75.55
LHS MEAN = 160.15900 SR = 0.00079

COEF	VALUE	ST ER	T-STAT	MEAN
RPMG3.0	-31.20740	13.44580	-2.32097	1.00000
RPMG3.1	0.06284	0.00563	11.15460	465.44100
RPMG3.2	0.24453	0.05355	4.56647	150.89800
RPMG3.3	0.61501	0.05145	11.95400	156.72300
RPMG3.4	27.47210	14.92660	1.84047	1.04943

28: RPPC3 = RPPC3.0+RPPC3.1*WPCH3+RPPC3.2*(WPCH3-WPCH3(-1))+RPPC3*ER34+RPPC3.4*RPPC3(-1)

NOB = 44 NOVAR = 4
RANGE = 1970 1 TO 1980 4
RSQ = 0.9794 CRSQ = 0.97785 F(3/40) = 633.849
SER = 8.1145 SSR = 2633.840 DW(0) = 0.38 COND(X) = 53.79
LHS MEAN = 162.29200 SR = 0.00545

COEF	VALUE	ST ER	T-STAT	MEAN
RPPC3.0	38.10920	4.21979	9.03106	1.00000
RPPC3.1	39.22370	10.84850	3.61559	2.16005
RPPC3.2	-48.43340	18.83850	-2.57098	0.05800
RPPC3.4	-0.83168	0.15529	-5.35553	158.17900

29: RPPM3 = RPPM3.0+RPPM3.1*(XWPPM3-XCSUP3/100)+RPPM3.2*PBOIL3+RPPM3.3*RPPM3(-1)

NOB = 44 NOVAR = 4
RANGE = 1970 1 TO 1980 4
RSQ = 0.99583 CRSQ = 0.99552 F(3/40) = 3183.550
SER = 5.3143 SSR = 1129.670 DW(0) = 1.75 COND(X) = 24.50
LHS MEAN = 169.15200 SR = 0.00237

COEF	VALUE	ST ER	T-STAT	MEAN
RPPM3.0	11.20440	2.33721	4.79393	1.00000
RPPM3.1	54.27500	5.48579	9.89375	0.95474
RPPM3.2	1.83221	0.47359	3.86879	7.86310
RPPM3.3	0.56184	0.04705	11.94090	163.25400

30: RPEM3 = RPEM3.0+RPEM3.1*WPEM3+RPEM3.2*PBOIL3+RPEM3.3*RPEM3(-1)

NOB = 44 NOVAR = 4
RANGE = 1970 1 TO 1980 4
RSQ = 0.99889 CRSQ = 0.99881 F(3/40) = 1.20E+04
SER = 2.5545 SSR = 261.025 DW(0) = 1.45 COND(X) = 71.33
LHS MEAN = 183.03200 SR = 0.00203

COEF	VALUE	ST ER	T-STAT	MEAN
RPEM3.0	0.75060	2.84065	0.26423	1.00000
RPEM3.1	0.46145	0.05551	8.31365	174.30400
RPEM3.2	1.06376	0.62429	1.70394	7.86310
RPEM3.3	0.52700	0.05769	9.13554	177.38800

31: WPCH3 = WPCH3.0+WPCH3.1*(4.32*XWPCB3+8.24*XWPPM3)+WPCH3.2*CIFC3(-1)/DFC3(-1)+WPCH3.3*WPCH3(-1)

NOB = 44 NOVAR = 4
RANGE = 1970 1 TO 1980 4
RSQ = 0.99272 CRSQ = 0.99218 F(3/40) = 1819.280
SER = 0.0675 SSR = 0.182 DW(0) = 1.48 COND(X) = 66.42
LHS MEAN = 2.16005 SR = 0.00006

COEF	VALUE	ST ER	T-STAT	MEAN
WPCH3.0	0.18066	0.11914	1.51634	1.00000
WPCH3.1	0.04882	0.01166	4.18806	19.35900
WPCH3.2	-0.07402	0.08170	-0.90599	1.08790
WPCH3.3	0.53031	0.11178	4.74414	2.10205

32: WPIC3 = WPIC3.0+WPIC3.1*JS1+WPIC3.2*JS2+WPIC3.3*JS3+WPIC3.4*(4.32*XWPCB3+8.24*XWPPM3)+WPIC3.5*WPIC3(-1)+WPIC3.6*DIC3

NOB = 44 NOVAR = 7
RANGE = 1970 1 TO 1980 4
RSQ = 0.99585 CRSQ = 0.99517 F(6/37) = 1478.270
SER = 4.9357 SSR = 901.347 DW(0) = 1.35 COND(X) = 80.32
LHS MEAN = 178.49900 SR = 0.00139

COEF	VALUE	ST ER	T-STAT	MEAN
WPIC3.0	-21.32400	14.82610	-1.43827	1.00000
WPIC3.1	4.07158	2.16081	1.88428	0.25000
WPIC3.2	-3.20616	9.28773	-0.34520	0.25000
WPIC3.3	-6.27902	10.85630	-0.57838	0.25000
WPIC3.4	2.97032	0.68994	4.30518	19.35900
WPIC3.5	0.71496	0.07359	9.71568	173.08500
WPIC3.6	0.27939	0.30697	0.91014	71.31660

33: WPEM3 = WPEM3.0+WPEM3.1*(4.32*XWPCB3+8.24*XWPPM3)+WPEM3.2*CIEM3(-1)+WPEM3.3*WPEM3(-1)

NOB = 44 NOVAR = 4
RANGE = 1970 1 TO 1980 4
RSQ = 0.99654 CRSQ = 0.99628 F(3/40) = 3834.610
SER = 4.1750 SSR = 697.238 DW(0) = 1.28 COND(X) = 50.11
LHS MEAN = 174.30400 SR = 0.00179

COEF	VALUE	ST ER	T-STAT	MEAN
WPEM3.0	3.64981	2.49360	1.46367	1.00000
WPEM3.1	0.68855	0.56132	1.22666	19.35900
WPEM3.2	-0.47931	0.13621	-3.51890	12.86130
WPEM3.3	0.96658	0.06256	15.45110	169.14300

34: PCMS3 = PCMS3.0+PCMS3.1*JS1+PCMS3.2*JS2+PCMS3.3*JS3+PCMS3.4*RPFM3+PCMS3.5*RPEM3+PCMS3.7*LOG(TIMEB)+PCMS3.8*PCMS3(-1)

NOB = 44 NOVAR = 8
RANGE = 1970 1 TO 1980 4
RSQ = 0.99643 CRSQ = 0.99573 F(7/36) = 1433.750
SER = 0.1014 SSR = 0.371 DW(0) = 2.13 COND(X) = 981.75
LHS MEAN = 12.23180 SR = 0.00035

COEF	VALUE	ST ER	T-STAT	MEAN
PCMS3.0	32.43370	5.10334	6.35539	1.00000
PCMS3.1	-0.35155	0.04996	-7.03729	0.25000
PCMS3.2	-0.37912	0.04554	-8.32546	0.25000

PCMS3.3	-0.19091	0.05154	-3.70408	0.25000
PCMS3.4	-0.02180	0.00407	-5.36383	155.17300
PCMS3.5	0.00774	0.00205	3.77474	183.03200
PCMS3.7	-4.82141	0.83110	-5.80122	4.22119
PCMS3.8	0.19016	0.12065	1.57606	12.34130

35: PCLM3 = PCLM3.0+PCLM3.1*JS1+PCLM3.2*JS2+PCLM3.3*JS3+PCLM3.4*LOG(RPFM3)+PCLM3.5*LOG(RPPM3)+PCLM3.6*LOG(PCDY3)+PCLM3.7*LOG(TIME)

NOB = 44 NOVAR = 8
RANGE = 1970 1 TO 1980 4
RSQ = 0.99739 CRSQ = 0.99688 F(7/36) = 1964.420
SER = 0.1212 SSR = 0.528 DW(0) = 2.02 COND(X) = 1121.68
LHS MEAN = 12.85960 SR = -0.00218

COEF	VALUE	ST ER	T-STAT	MEAN
PCLM3.0	-36.37020	1.15333	-31.53490	1.00000
PCLM3.1	-0.16487	0.06022	-2.73785	0.25000
PCLM3.2	-0.42073	0.05741	-7.32883	0.25000
PCLM3.3	-0.88545	0.11265	-7.86011	0.25000
PCLM3.4	-2.78653	0.44547	-6.25529	4.99698
PCLM3.5	0.40104	0.12119	3.30914	5.03883
PCLM3.6	1.92124	0.88813	2.16324	7.05079
PCLM3.7	11.31300	1.36300	8.30007	4.23889

36: PCCRM3 = PCCRM3.0+PCCRM3.1*JS1+PCCRM3.2*JS2+PCCRM3.3*JS3+PCCRM3.4*LOG(RPFM3)+PCCRM3.5*LOG(PCDY3)+PCCRM3.6*LOG(PCCRM3(-1))+PCCRM3.7*LOG(TIMEB)

NOB = 44 NOVAR = 8
RANGE = 1970 1 TO 1980 4
RSQ = 0.91862 CRSQ = 0.9028 F(7/36) = 58.054
SER = 0.0800 SSR = 0.230 DW(0) = 1.67 COND(X) = 777.19
LHS MEAN = 3.13923 SR = 0.00012

COEF	VALUE	ST ER	T-STAT	MEAN
PCCRM3.0	3.03825	0.83378	3.64393	1.00000
PCCRM3.1	-0.34026	0.04037	-8.42745	0.25000
PCCRM3.2	-0.04045	0.06183	-0.65431	0.25000
PCCRM3.3	-0.30731	0.06260	-4.90898	0.25000
PCCRM3.4	-1.08503	0.30161	-3.59747	4.99698
PCCRM3.5	2.22688	0.42647	5.22173	7.05079
PCCRM3.6	1.37716	0.40881	3.36873	1.13552
PCCRM3.7	-2.74098	0.54263	-5.05133	4.22119

37: LOG(PCCB3) = PCCB3.0+PCCB3.1*JS1+PCCB3.2*JS2+PCCB3.3*JS3+PCCB3.4*LOG(RPCB3)+PCCB3.5*LOG(TIMEB)+0.3*LOG(RPMG3)+(-PCCB3.4-0.3)*LOG(PCDY3)+PCCB3.6*D8081

NOB = 44 NOVAR = 7
RANGE = 1970 1 TO 1980 4
RSQ = 0.88254 CRSQ = 0.86349 F(6/37) = 46.331
SER = 0.0679 SSR = 0.171 DW(0) = 1.81 COND(X) = 136.19
LHS MEAN = 0.30910 SR = -0.00008

COEF	VALUE	ST ER	T-STAT	MEAN
PCCB3.0	5.11212	0.29764	17.17530	1.00000
PCCB3.1	-0.10883	0.03015	-3.60961	0.25000
PCCB3.2	-0.11621	0.02918	-3.98266	0.25000
PCCB3.3	-0.09615	0.03575	-2.68992	0.25000
PCCB3.4	-0.57148	0.20294	-2.81597	-2.08223
PCCB3.5	-1.25758	0.13280	-9.46936	4.22119
PCCB3.6	0.03963	0.03446	1.15020	0.13636

38: PCFC3 = PCFC3.0+PCFC3.1*LOG(RPPC3)+(PCFC3.2+PCFC3.3*JS1+PCFC3.4*JS2+PCFC3.5*JS3)*LOG(PCDY3)+PCFC3.6*LOG(RPBF3)

NOB = 44 NOVAR = 7
RANGE = 1970 1 TO 1980 4
RSQ = 0.91287 CRSQ = 0.89874 F(6/37) = 64.608
SER = 0.0776 SSR = 0.223 DW(0) = 2.16 COND(X) = 357.77
LHS MEAN = 1.55509 SR = -0.

COEF	VALUE	ST ER	T-STAT	MEAN
PCFC3.0	-2.55033	0.34058	-7.48818	1.00000
PCFC3.1	-0.29750	0.22757	-1.30726	5.03351
PCFC3.2	0.63052	0.21624	2.91584	7.05079
PCFC3.3	-0.01680	0.00486	-3.46049	1.73610
PCFC3.4	-0.00605	0.00477	-1.26845	1.75992
PCFC3.5	-0.01114	0.00567	-1.96664	1.78783
PCFC3.6	0.24352	0.07234	3.36633	4.99731

39: PCIC3 = PCIC3.0+PCIC3.1*JS1+PCIC3.2*JS2+PCIC3.3*JS3+PCIC3.4*LOG(RPIC3)+PCIC3.5*LOG(RPHC3)+PCIC3.6*LOG(PCDY3)

NOB = 44 NOVAR = 7
RANGE = 1970 1 TO 1980 4
RSQ = 0.97794 CRSQ = 0.97437 F(6/37) = 273.405
SER = 0.1157 SSR = 0.496 DW(0) = 2.32 COND(X) = 482.85
LHS MEAN = 3.14657 SR = 0.00004

COEF	VALUE	ST ER	T-STAT	MEAN
PCIC3.0	3.27746	0.58509	5.60167	1.00000
PCIC3.1	0.00918	0.05155	0.17815	0.25000
PCIC3.2	1.29268	0.05051	25.59140	0.25000
PCIC3.3	1.55475	0.05747	27.05280	0.25000
PCIC3.4	-0.20595	0.63194	-0.32591	4.99503
PCIC3.5	0.30930	0.26038	1.18787	5.11748
PCIC3.6	-0.19843	0.31345	-0.63306	7.05079

40: PCEM3 = PCEM3.0+PCEM3.1*JS1+PCEM3.2*JS2+PCEM3.3*JS3+PCEM3.4*LOG(RPEM3)+PCEM3.5*LOG(PCDY3)+PCEM3.6*LOG(TIME)

NOB = 44 NOVAR = 7
RANGE = 1970 1 TO 1980 4
RSQ = 0.46334 CRSQ = 0.37632 F(6/37) = 5.324
SER = 0.2525 SSR = 2.359 DW(0) = 2.28 COND(X) = 1027.59
LHS MEAN = 1.00012 SR = 0.00047

COEF	VALUE	ST ER	T-STAT	MEAN
PCEM3.0	3.19582	2.52856	1.26389	1.00000
PCEM3.1	0.08771	0.12306	0.71270	0.25000
PCEM3.2	-0.03842	0.12371	-0.31059	0.25000
PCEM3.3	-0.26003	0.23756	-1.09456	0.25000
PCEM3.4	-1.80297	0.89140	-2.02262	5.12781
PCEM3.5	2.95463	1.93868	1.52404	7.05079
PCEM3.6	-3.23910	2.78306	-1.16386	4.23889

41: DPM3 = DPM3.0+DPM3.1*RPPM3+DPM3.2*RPFM3+DPM3.3*PCDY3*POPN3+DPM3.4*DPM3(-1)+DPM3.5*DPM3(-2)+DPM3.6*TIME

NOB = 44 NOVAR = 7
RANGE = 1970 1 TO 1980 4
RSQ = 0.35511 CRSQ = 0.25053 F(6/37) = 3.396
SER = 8.1473 SSR = 2456.000 DW(0) = 1.90 COND(X) = 103.65
LHS MEAN = 12.82450 SR = 0.00091

COEF	VALUE	ST ER	T-STAT	MEAN
DPM3.0	41.02710	22.54480	1.81980	1.00000
DPM3.1	-0.13473	0.04660	-2.89147	169.15200
DPM3.2	0.04178	0.15159	0.27565	155.17300
DPM3.3	9.50981E-04	7.19170E-04	1.32233	28523.60000
DPM3.4	-0.52784	0.14516	-3.63630	13.13390
DPM3.5	-0.47668	0.14671	-3.24906	13.27790
DPM3.6	-0.36539	0.60185	-0.60712	70.50000

```
45:  XGTM3 = (1-D1975)*(XGTM3.0+XGTM3.1*JS1+XGTM3.2*JS2+XGTM3.3*JS3+XGTM3.4*XFTM3(-2)+XGTM3.5*
XGTM3(-1))+D1975*(JS1*XFTM3(-2)+JS2*XFTM3(-2)+JS3*(0.667*XFTM3(-2)+0.333*XFTM3(-3))+JS4*XFTM3(-3))


NOB = 44      NOVAR = 6
RANGE =  1970 1 TO 1980 4
RSQ =    0.99661      CRSQ =    0.99617      F(5/38) =  2237.460
SER =    0.4857       SSR =     8.964        DW(0) =   1.45      COND(X) =   243.15
LHS MEAN =      21.66650      SR =      -6.50138

COEF            VALUE           ST ER          T-STAT          MEAN

XGTM3.0      -19.90350        6.64595        -2.99483        0.45455
XGTM3.1       -0.31795        0.33237        -0.95660        0.11364
XGTM3.2        0.70042        0.36175         1.93619        0.11364
XGTM3.3        0.29472        0.30830         0.95596        0.11364
XGTM3.4        1.54511        0.56771         2.72167        8.81667
XGTM3.5        0.27488        0.32498         0.84585        6.09231


46:  XAPM3 = XAPM3.0+XAPM3.1*(4.32*XWPCB3+8.24*XWPPM3)+XAPM3.2*XAPM3(-1)


NOB = 44      NOVAR = 3
RANGE =  1970 1 TO 1980 4
RSQ =    0.97965      CRSQ =    0.97866      F(2/41) =   987.077
SER =    0.1142       SSR =     0.535        DW(0) =   1.71      COND(X) =    34.58
LHS MEAN =      2.57767      SR =      0.00004

COEF            VALUE           ST ER          T-STAT          MEAN

XAPM3.0        0.17207        0.07572         2.27233        1.00000
XAPM3.1        0.03855        0.01059         3.64102       19.35900
XAPM3.2        0.65802        0.10194         6.45517        2.52172


49:  XWPPM3 = IF XGTM3-XGTM3(-1) EQ 0 THEN XWPPM3(-1) ELSE XWPPM3.0+XWPPM3.1*XGTM3+XWPPM3.2*
EXPPM3+XWPPM3.3*GIPM3(-1)


NOB = 44      NOVAR = 4
RANGE =  1970 1 TO 1980 4
RSQ =    0.99949      CRSQ =    0.99945      F(3/40) =  2.60E+04
SER =    0.0126       SSR = 6.312E-03        DW(0) =   1.52      COND(X) =    10.33
LHS MEAN =      1.20677      SR =      0.00004

COEF            VALUE           ST ER          T-STAT          MEAN

XWPPM3.0      -0.27828        0.01179       -23.59920        0.54545
XWPPM3.1       0.06761    3.39199E-04       199.33500       12.91920
XWPPM3.2       0.05545        0.01308         4.23998        0.35103
XWPPM3.3 -2.16091E-04    9.09135E-05        -2.37688       13.44100
```

51: XPFM3 = XPFM3.0+XPFM3.1*JS1+XPFM3.2*JS2+XPFM3.3*JS3+XPFM3.4*XDCC12(-2)+XPFM3.5*XPFM3(-1)

NOB = 44 NOVAR = 6
RANGE = 1970 1 TO 1980 4
RSQ = 0.99578 CRSQ = 0.99523 F(5/38) = 1795.200
SER = 0.5030 SSR = 9.616 DW(0) = 0.84 COND(X) = 126.67
LHS MEAN = 24.03500 SR = 0.00046

COEF	VALUE	ST ER	T-STAT	MEAN
XPFM3.0	-0.08763	0.37648	-0.23275	1.00000
XPFM3.1	-0.53501	0.22732	-2.35362	0.25000
XPFM3.2	-0.30121	0.22383	-1.34569	0.25000
XPFM3.3	-0.73486	0.21626	-3.39803	0.25000
XPFM3.4	0.05983	0.02285	2.61801	151.69000
XPFM3.5	0.65704	0.14011	4.68959	23.49910

59: LOG(RPDP3/RPDP3(-1)) = RPDP3.1*(1.15*LOG(RPFM3/RPFM3(-1))+0.22*LOG(RPCB3/RPCB3(-1))+0.35*LOG(RPPC3/RPPC3(-1))+0.03*LOG(RPPM3/RPPM3(-1))+0.05*LOG(RPEM3/RPEM3(-1))+0.14*LOG(RPIC3/RPIC3(-1)))/2.31

NOB = 44 NOVAR = 1
RANGE = 1970 1 TO 1980 4
RSQ = 0.99279 CRSQ = 0.99279 F(0/43) = 5924.210
SER = 1.80E-03 SSR = 1.393E-04 DW(0) = 2.32 COND(X) = 1.00
LHS MEAN = 0.02269 SR = 0.00693

COEF	VALUE	ST ER	T-STAT	MEAN
RPDP3.1	1.19176	0.01049	113.66100	0.01891

60: CRDY3 = CRDY3.0+CRDY3.1*XPFM3*SMFP3+(CRDY3.2+CRDY3.3*JS1+CRDY3.4*JS2+CRDY3.5*JS3)*XNTM3*SMMC3

NOB = 44 NOVAR = 6
RANGE = 1970 1 TO 1980 4
RSQ = 0.99594 CRSQ = 0.9954 F(5/38) = 1862.680
SER = 9.2731 SSR = 3267.660 DW(0) = 1.59 COND(X) = 39.27
LHS MEAN = 357.77600 SR = 0.00998

COEF	VALUE	ST ER	T-STAT	MEAN
CRDY3.0	-1.28858	4.95394	-0.26011	1.00000
CRDY3.1	1.42197	0.10056	14.14060	138.96000
CRDY3.2	0.72645	0.09295	7.81540	231.01100
CRDY3.3	-0.11606	0.02262	-5.13194	39.57210
CRDY3.4	-0.06190	0.03884	-1.59389	71.50130
CRDY3.5	0.03708	0.03837	0.96637	72.00340